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ABSTRACT

This Technology & Innovations in Education (TIE) workshop, presented in Kansas City, Missouri, on May 2, 1997, was designed to help participants gain a valid big picture of current school technology change issues, acquire current materials, clarify their beliefs, vision, and needs for their district's technology efforts, learn strategies for enhancing technology leadership efforts, and build their networks. This publication contains the following sections: (1) Outcomes and Agenda; (2) Building a Sound Big Picture for Technology Leadership -- thumbnail sketches of slides, matrix comparing communications age and industrial age teaching and learning, viewing educational technology through systems and resources, technical infrastructure, people infrastructure, and technology-based teaching and learning, and technology leadership resource materials; (3) Getting Focused for Sound Technology Leadership -- clarify philosophical base, maximize knowledge and experience base, describe the vision for your district, and assess gaps, resources, and constraints; (4) Pursuing Strategies and Tools for Enhancing Technology Leadership -- communications for relating to audience, graphic organizers for systems thinking, rules for decision making, relationships with consultants and partners, critical friend approach to professional growth, technology as a core value, practical base for web-based teaching and learning, support system for technology-related infrastructure, and measurement of the instructional use of technology; and (5) Technology Leadership Workshop Evaluation Form. (DLS)

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ED 425 700

chnology leadership workshop

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Outline of Technology Leadership Workshop Materials

I. Building a Sound Big Picture for Technology Leadership

A. Thumbnail Sketches of "Big Picture" Slides
B. Matrix Comparing Communications Age and Industrial Age Teaching and Learning
C. Viewing Educational Technology Through a Grid of Four Areas
- Systems and Resources
- Technical Infrastructure
- People Infrastructure
- Technology-infused Teaching and Learning

D. Technology Leadership Resource Materials and Articles

II. Getting Focused for Sound Technology Leadership

A. Clarify Your Philosophical Base
B. Maximize Your Knowledge and Experience Base
C. Describe the Vision You Possess for Your District
D. Assess Gaps, Resources, and Constraints

III. Pursuing Strategies and Tools for Enhancing Technology Leadership

A. Communications for Relating to Audience
B. Graphic Organizers for Systems Thinking
C. Rules for Decision Making
D. Relationships with Consultants and Partners
E. Critical Friend Approach to Professional Growth
F. Technology as a Core Value
G. Practical Base for Web-based Teaching and Learning
H. Support System for Technology-Related Infrastructure
I. Measurement of the Instructional Use of Technology

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Spring 1997

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Outcomes and Agenda

Technology Leadership Workshop
Crown Plaza
Kansas City, Missouri
May 2, 1997

Workshop Outcomes

Workshop Participants:

- Gain a valid " big picture" of current school change issues related to technology,
- Acquire current materials addressing technology leadership issues,
- Clarify their beliefs, vision, and needs for their district's technology efforts,
- Learn about strategies for enhancing their technology leadership efforts, and
- Build their networks of school leaders regarding technology efforts.

Workshop Agenda

9:00-9:30 a.m.	Introductions and Agenda Overview
9:30-10:30 a.m.	I. Building a Sound Big Picture for Technology Leadership
10:30-10:45 a.m.	Break
10:45-11:00 a.m.	Resources and Materials for Leaders
11:00-11:30 a.m.	II. Getting Focused for Sound Technology Leadership
	A. Clarify Your Philosophical Base
11:30-12:00 p.m.	B. Maximize Your Knowledge and Experience Base
12:00-1:00 p.m.	Lunch
1:00-1:30 p.m.	C. Describe the Vision You Possess for Your District
1:30-2:00 p.m.	D. Assess Gaps, Resources, and Constraints
2:00-2:15 p.m.	Break
2:15-3:00 p.m.	III. Pursuing Strategies for Enhancing Technology Leadership
3:00-3:30 p.m.	Networking and Sharing Strategies
3:30-4:00 p.m.	Evaluation and Wrap-up

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Building a Sound Big Picture for Technology Leadership

I. Building a Sound Big Picture for Technology Leadership

Pursuing sound and meaningful technology leadership requires a valid understanding of current educational issues surrounding rapidly advancing technology. Thus, the impact of educational technology should be considered within the context of our changing world. Educational stakeholders--students, teachers, administrators, and community members--face a Communications Age environment with a host of societal and economic implications of global proportions. These dramatic shifts require reforms in educational structures and practices that are associated with the institution traditionally called school.

A. Thumbnail Sketches of "Big Picture" Slides

In order for leaders to maintain a sound technology leadership perspective, they must consider the bigger picture. The following pages include selected thumbnail sketches of slides that capture and highlight issues and considerations potentially impacting technology leadership. The slides raise fundamental topics such as What is appropriate curriculum for schools in the late 90's? What is a valid icon for school as it stretches beyond the bounds of a little red building with a bell on top? and What are the implications of emerging and future technologies for education?.

B. Matrix Comparing Communications Age and Industrial Age Teaching and Learning

Most educators are comfortable with the teaching and learning environment associated with the Industrial Age. In that era, school was primarily a "place" where students went to access the information resources for building knowledge and basic skills. As information becomes available nearly "anyplace" in the Communications age, the role of school and the roles of educational stakeholders are changing. To gain a clearer perspective of these shifts, a matrix suggesting changes from Industrial Age to Communications Age Teaching and Learning environments is included as a graphic in this section of the workshop manual.

C. Viewing Educational Technology Through a Grid of Four Areas

As educational technology made its entrance into educational settings, the majority of the attention was directed towards the hardware. Progressive and responsible

school leaders recognize the importance of looking at the bigger picture that considers the implications in a broader context. To assist leaders in framing educational technology issues, the workshop developers encourage school leaders to view technology-related issues through a grid of fundamental topics that raise important considerations. Certainly, there is overlap amongst the areas, but the framework offers a structure for considering a broad range of important related issues. For the purposes of the workshop discussions and activities, the suggested areas for the grid include:

- **Systems and Resources**

This area refers to the school organization and structures such as policies, governance structure, facilities, administration, school calendar, and community involvement. Also, this area includes fiscal issues accompanying the annual budget for the school system.

- **Technical Infrastructure**

This area addresses the physical components that represent the technical infrastructure for the district's technology efforts.

- **People Infrastructure**

This area is concerned with the human element of the district's technology effort. In particular, this area addresses building the capacity of stakeholders--students, teachers, administrators, and community members--to access and implement technology tools and products successfully.

- **Technology-infused Teaching and Learning**

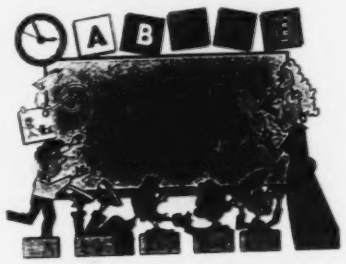
This area refers to the day-to-day business of education. That is, the effective integration of technology as a vital tool and resource for providing and facilitating teaching and learning in response to the Communications Age paradigm for schooling.

D. Technology Leadership Resource Materials and Articles

Technology Leaders can benefit from materials and resources that summarize vital issues and offer ideas for addressing educational technology. This section of the workshop manual includes key documents and articles to support basic educational technology leadership.

1

Ten thousand years ago, the basics of education were quite different. Reading and writing had not been invented. Information was stored and passed on mainly through a combination of oral tradition and artifacts such as tools. The development of reading and writing clearly brought with it a significant addition to basics...Thus, the basics can and do change. However, they do not change very often. The three Rs have been with us for thousands of years. We have no indication that they will suddenly disappear.



2

Because of the emergence of multimedia technology, we are being forced to expand one of the cornerstones of our academic culture.

The 3 Rs are becoming the 4 Rs: **Reading, 'Riting, 'Rithmatic,** and **aRt.**

3

With the growing popularity of multimedia comes "the language of multimedia." There are three major components to this language:

An understanding of the "grammar" of aesthetic presentation, loosely referred to as "design."

A grasp of skills needed to manipulate media in meaningful ways; and

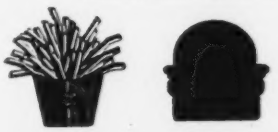
The ability to use these skills to express a vision in terms others can appreciate

4

In schools where the curriculum is a mass to be swallowed, where students are fed information meals all too similar to fast food—high in fat, low in nutrition—we should not be asking how to employ the Internet to support curriculum. We should first be asking what kind of curriculum is appropriate in 1997.

We should first change the curriculum to focus on learning. Schools should be much more about students making meaning rather than merely committing someone else's insights to memory. Learning ought to be much more like cooking than eating.
But not microwave cooking!

Jamieson McKenzie, ***From Now On***, January 1997



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5

While schooling in the 19th and 20th centuries was primarily about students mastering processed information—the core curriculum—it is likely that schooling and learning during the next century will be characterized by far more **PROSPECTING**—the purposeful, skilled, but somewhat haphazard search for insight and truth across a complicated information landscape.

Why? Because information problem-solving skills will be paramount—the basic foundation for a robust career and life.

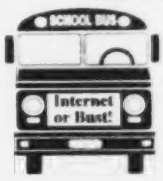
Jamieson McKenzie. *From Now On.* January 1997.

6

We need to acknowledge up front that the Internet was not designed with schools in mind. It is not an information compacting device like a textbook. The information is usually presented with little thought to how it might be used in a school by a teacher and a classroom of students. Rarely do we find a "teacher's guide."

As long as the Internet presents itself as a highly disorganized frontier, schools must make a major investment in organizing "tours" to the best information sites. The inefficiencies of creating insight and making meaning may otherwise overwhelm the advantages.

Jamieson McKenzie. *From Now On.* January 1997.



7

The emerging literacy we all must master requires diving into a sea of information and immersing ourselves in data in order to harvest patterns of knowledge, just as fish extract oxygen from water with their gills.

As educators, understanding how to structure learning experiences to make such immersion possible is the core of the new rhetoric.

Expanding traditional definitions of literacy and rhetoric into immersion-centered experiences of interacting with information is crucial to preparing students for full participation in 21st-century society.

Chris Dede. *Learning and Leading With Technology.* 1995.

8

For communities that successfully tap the power of today's technology, *going to school* in the future will have little to do with transporting students to information.

It will be about moving information to students.

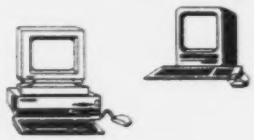
School will be *everywhere*.

Odvard Egil Dyrli and Daniel Kinnaman. *Technology & Learning*, May/June 1994.

9

My son and others fortunate to have access to the Internet testify that the very foundations of schooling are shaking beneath us, as if in the throes of an earthquake. What students learn, how they learn, who they learn with, and where they learn are shifting, moved by the cultural equivalent of plate tectonics. Bill Crocoll, superintendent in Chittenden, Vermont—a school district nationally recognized for technology usage —says technologies like the Internet force us to stop thinking of school as a place and focus on school as a concept.

Ralph Bruser, *TECHNOS*, Fall 1995



10

...the first step to creating a new generation of American schools is to think small and interconnected. Instead of our present capital-intensive physical plants stuffed with teachers, students, and curriculum resources, we now have the opportunity to think of school more in terms of an interconnected global network of neighborhood gathering places.

11

Even among those teachers most proficient with technology, many classrooms are still teacher centered; to the disadvantage of the learner, roles are not changing. In many cases, this is because teachers do not have a vision of life in the approaching century.

Dwight Holt, *ASCD Curriculum/Technology Quarterly*, Spring 1995

12

Most of the talk about the convergence of televisions, telephones, and computers misses the point.

Convergence is simple: the PC is it!

Everything else—televisions, telephones, radios, fax machines, and more—eventually gets sucked into the PC, cannibalized by ever faster and more powerful processors.

Dan Gutman, *Technology & Learning*, Nov/Dec 1995

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13

Digital life will include very little real-time broadcast. As broadcast becomes digital, the bits are not only easily time-shiftable but need not be received in the same order or at the same rate as they will be consumed.

For example, it will be possible to deliver one hour of video over fiber in a fraction of a second (some experiments today show that the time needed to deliver one hour of VHS-quality video can be as small as one-hundredth of a second)

On-demand information will dominate digital life. We will ask explicitly and implicitly for what we want, when we want it.

Nicholas Negroponte, *Being Digital*, 1995

14

Our vision of a fourth-grade classroom in the year 2016…Each student has a notebook-sized computer on his or her desk…The classroom's computers are networked into the teacher's master computer, which acts as a file server and a massive storage device. The computers are also connected to the library where thousands of CD-ROM disks can be "borrowed" to the laptops. CD-ROM disks in 2016 are made in the classroom. They hold text, color, sound, video, and camera-quality graphics.

15

The teacher in this classroom has to play many roles. She is part computer technician and part information highway tour guide. A big part of her job involves record management, thus her computer is larger and more expensive than the students' laptops. Although the computer has made her job easier, it has not replaced the teacher. She is still the resident expert on curriculum, learner behavior, and motivation.

16

We are living in a time of rapid change. **However, change is a relative thing. Our parents also lived in times of rapid technological change. Changes such as the telephone, automobile, airplane, and television seem mind-boggling to me.** In any case, it is the adults who are stressed by the change—not the children.

David Mountund, 1991

17

Why, if most educators believe that technology can improve the educational process, is it so difficult to implement and integrate? Why do so many educators have difficulty deciding how to use technology in the classroom? **How can American schools spend so much money on technology yet be so unclear about how to use it?** Why are there still so many unanswered questions concerning the use of technology in the classroom?

Ken Kwapinski, *Learning and Leading With Technology*, 1997

18

What is technology then? Technology is a tool that has many things in common with the previously listed educational components. But because it is none of these things, it needs its own place in the educational system....Many schools systems could radically improve their chances of integrating technology successfully if they considered technology as a *core value*.

Ken Kwapinski, *Learning and Leading With Technology*

WHAT'S TECHNOLOGY

19

Jon Saphier and John D'Auria (1993) define a core value as a "central belief deeply understood and shared by every member of an organization; they focus its energy and are the anchor point for all its plans." According to Saphier and D'Auria, a core value should permeate all of the organization's undertakings and plans, drive decision-making, and be the very last thing the organization would give up. In addition, a violation of the core value should elicit a strong reaction.

Ken Kwapinski, *Learning and Leading With Technology*, 1997

20

Comparing Characteristics of "Successful" Programs with Typical School Technology Programs...

"Successful" School Program	Typical School Technology Program
• Broad-based leadership with key movers and shakers	• One harried and overworked technology enthusiast who attempts to do all things for all staff members
• Clear vision	• Multitude of different visions
• Administrative backing	• Lukewarm administrative support
• Dedicated staff	• Blended department of professionals and assistants with various "hats"
• An adequate budget	• A budget that varies with the political wind, isolated technology fires that are soon extinguished
• A sound evaluation system	• No truly effective evaluation system that can measure the success of technology integration

Adapted from Ken Kwapinski, *Learning and Leading With Technology*, 1997

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ISSUES AND CHALLENGES TO REACHING THE VISION

Vision of **New Learning Environments** **"Communications Age"**	**Picture of** **Current Learning Environments** **Primarily "Industrial Age"**
School is everywhere Communities of learners Dynamic, flexible, evolving curriculum	School is a place Classroom groups of students Textbook driven, static curriculum
Learner centered processes and practices for learning	Teacher directed processes and practices for learning
Equitable access and seamless infusion of technology	Inequitable access and use of technology as an add-on
Technology facilitates multimedia-based communication, information sharing, collaboration	Technology primarily automates "traditional" practices
The pursuit of professional excellence is continuous and supported with new models and resources	Professional development opportunities are limited, detached from research and under funded
Teaching and learning reflect an increased quality of understanding and standards of excellence	Teaching and learning primarily reflect a quantitative level of understanding and varying degrees of excellence
New flexible and expanded roles for educational community stakeholders exist	Single focus roles for stakeholders are the norm
New organizational models of systems support a Communications Age vision of learning	School systems support linear learning sequences, time bound units of work, and age determined cohorts

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TIE Technology Leadership Knowledge Base

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Selected Web Sites for Technology Leadership

The Web offers a world of information and support for technology leaders. A few recommended sites providing strong, relevant information include:

- McREL's Technology Connections Site
  http://www.mcrel.org/connect/tech/index.html

- NC-RTEC's Site
  http://www.ncrtec.org

- Resource Page for Technology Coordinators Site
  http://cybergate.com/~blesig/hoffman/tech_coord.html

- *From Now On* Publication Site
  http://fromnowon.org/

RECOMMENDED PUBLICATIONS FOR EDUCATIONAL TECHNOLOGY LEADERS

Prepared by TIE, Fall 1996

CLASSROOM CONNECT: The K-12 Educator's Practical Guide to Using the Internet. Published nine times a year for $39 by Wentworth Worldwide Media, Inc., P.O. Box 10488, Lancaster, PA 17605-0488. To subscribe or obtain a sample issue, Email to: connect@wentworth.com. Sample articles: *How to Teach Teachers about the Internet, New User Basics, Lesson Plan Goldmines.*

ELECTRONIC LEARNING: Your Resource for Technology and School Change. Published six times a year for $23.95 by Scholastic Inc. Subscription correspondence address: P.O. Box 3797, Boulder, CO 80322-3797. Sample article: *Emerging Technologies - New for Early Childhood.*

INVENTING TOMORROW'S SCHOOLS: News, Views & Previews of Information Age Learning & Teaching. Published six times a year for non-profit institutions at $139 by The Global Village Schools Institute, PO Box 22075, Alexandria, VA 22304. Voice mail: 703-823-6853. Email GVSMECK@AOL.COM.

LEARNING AND LEADING WITH TECHNOLOGY: The Journal of Educational Technology Practice and Policy. Published eight times a year for $61 ($55 membership dues include subscription) by the International Society for Technology in Education, 1787 Agate St., Eugene, OR 97403-1923. Phone: 541-346-4414. Internet: ISTE@oregon.uoregon.edu. Sample articles: *Using Windows in the Multimedia Classroom, Mining the Internet, Technology-Driven Systemic Change.*

TECHNOLOGY & LEARNING. Published eight times a year for $24 by Peter Li, Inc., PO Box 49727, Dayton, OH 45449-0727. Phone: 1-800-543-4383. Sample articles: *Special Software for Special Kids, Surfing the World Wide Web to Education Hot-Spots.*

TECHNOS: Journal of the Agency for Instructional Technology. Published quarterly for $20 a year by TECHNOS Press, Box A, Bloomington, IN 47402-0120. Phone: 812-339-2203. Email: technos@linknet.com. Sample articles: *The Internet as School, or Welcome to our MUD Room, Should Governors Control their State's Public Education Systems?*

THE JOURNAL: Technological Horizons in Education. Published eleven times a year for $29 (free to qualified individuals) by The Journal, 150 El Camino Real, Suite 112, Tustin, CA 92680-3670. URL address: http://www.thejournal.com. Phone: 714-730-4011. Sample articles: *Creating the Records Management Program in the Arlington Independent School District, Adult Supervision in the Distance Learning Classroom: Is it Necessary?, Find it on the Web.*

THREE KEY RESOURCES FOR EDUCATIONAL TECHNOLOGY LEADERSHIP

Prepared by TIE, Fall 1996

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BY SETH J. ITZKAN

Assessing the Future of Telecomputing Environments

Implications for Instruction and Administration

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The tools of technological forecasting and assessment provide insight into the online world that lies ahead.

No educational administrator can fail to notice the rumblings of change coming at the hands of telecomputing technologies. These technologies include audio-visual computing, the Internet, Information Highways, and others. But what will their lasting effects be, and how are planners to anticipate them? The tools of technological forecasting and assessment can provide helpful insights. Although these tools have traditionally been the province of business and government, it is now essential that they find a home in the academic professions.

There are four methods commonly used for a technology forecast and assessment. These are (1) expert opinions, (2) leading indicator analysis, (3) trend analysis, and (4) diffusion theory. Each of these provides a unique perspective, revealing the significance of the technology, its rate of change, and the process of its adoption.

Expert Opinion

Expert opinion is the first and easiest method of a technical forecast. It lets one know what the leaders of the time have to say about the topic on hand. It is a temperature gauge of current thinking. In regards to telecomputing, the temperature gauge reads "hot." Experts are promising comprehensive connectivity and global multimedia telecomputing between schools before the turn of the century. In a speech to the World Future Society last July, Raymond Smith, CEO of Bell Atlanta stated,

> "Today we are wiring schools throughout our region with interactive video, tomorrow a real time global interactive university...sooner than you'd ever believe."

In mirroring this rhetoric, Vice President Al Gore has challenged the telecommunications industry to "connect all of our classrooms, all of our libraries, and all of our hospitals and clinics by the year 2000." This is powerful language from powerful people. In as much as one is a company executive and the other a politician, the school administrator may be skeptical, but must not dismiss the significance of these statements. On these comments alone, prudence would suggest serious investigation into school models that support comprehensive, national, and international connectivity.

Leading Indicators

Expert opinion, however, means nothing if the evidence is not there to corroborate it. The leading indicators are those phenomena that are "signs of things to come." In regards to emerging telecomputing technologies, most applications are marketed toward the business community, and so their significance for education is not always apparent. Nonetheless, we are seeing that the time it takes for a technology to move from the domain of business to the domain of education is shrinking rapidly. Many emerging technologies in the business world today are only a few years from being an emerging technology for education. These are thus leading indicators. There are three kinds of leading indicators to investigate, those regarding future computing, future telecommunications, and future applications:

Future Computing

- Audio-visual Computing—the merging of analog and digital signals into a single data format. This allows computer and communications operations to be readily intermixed on a workstation. Examples are the new MAC AVs, and the Silicon Graphics Indy. Each is capable of seamless handling of video and audio in a traditional computing environment.

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- PowerPCs—new line of RISC-based computers from Apple and IBM. These will be the first generation of mass-marketed computers specifically made to handle the intensive memory and computational requirements of real-time multimedia. Audio and visual signal manipulation will no longer be an incapacitating strain on the system. Traditional computing applications, such as spreadsheets and document processors will run five to 10 times as fast as they do on today's top 486 and Quadra models.
- Personal Digital Assistants (PDAs)—computer notepads, used as address books, schedulers, and memo keepers, but also sporting such advanced features as handwriting recognition, voice activation, and even E-mail, fax, and cellular capabilities. Future models will be targeted for wider markets, including education. PDAs with CD-ROM capability is a plausible achievement by decade's end.

Future Telecommunications

- ISDN—the Integrated Services Digital Network. Primarily this is an advanced form of phone service that will also offer video capabilities. Future applications will include basic video-phone conferencing and data transfer over a single conduit. The significance for schools is that "phone service" will affect curriculum. It forces academic and facilities considerations to be discussed under a common umbrella.
- ATM—Asynchronous Transfer Mode. A new networking technology designed specifically to meet the demands of real-time, high fidelity audio and visual telecomputing. ATM unites the services of data, voice-telephone, and videoconferencing into a single network. Bandwidth may be up to 2.4 Gigabytes per second—2,000 times the speed of standard Internet connections. At such speeds, the Grolier encyclopedia could be downloaded in seconds.
- Internet/Information Highways—the emerging infrastructure of America's telecomputing environment. The Internet is the computer network that now links hundreds of thousands of schools, libraries, and research institutions around the world. The Information highways are the future manifestations of technologies like the Internet, except that they will provide commercial and entertainment services and likely be accessed through interactive television. Initial services provided will be fairly pedestrian, such as home shopping, movies on demand, and choice of camera angles for sporting events. But, in time, powerful educational applications should also be expected, such as the capability to receive home instruction from the college or university of one's choice, or to have a group conversation (through your T.V.) with classmates.

Future Applications

- Video Servers—devices which convert analog T.V. signals to digital and that work as LAN-based storage for video-mail, news reels, or other video segments. Applications for schools include online video libraries, providing, for example, retrieval of famous speeches, inaugural addresses, or presidential debates.
- Distributed Multimedia—the integration of multimedia into distributed computing environments. A sample application is the inclusion of voice with E-mail. For schools, this could bode well with foreign language partners, who may include their speaking as well as writing.
- Virtual Meetings—the addition of voice to online keyboard conferences. In virtual meetings, written and spoken comments are archived together and can be reviewed and responded to. Anonymous voting and real-time document sharing may also be included. For schools, this will be the logical evolution of the Internet Relay Chats (IRCs) which are increasingly common today. Online guests will be able to give both typed and spoken communications to students through the computer network.

We are seeing that the time it takes for a technology to move from the domain of business to the domain of education is shrinking rapidly.

Trend Analysis

Once the leading indicators have confirmed that changes are on their way, the rate must be determined. Trend analysis is the quantitative assessment of the growth or decline of phenomena over time. Concerning the adoption of instructional telecomputing, the trends of immediate interest are the growth of personal computers and networking in schools. How widespread are these phenomena, and how fast is their proliferation?

Microcomputers in Schools

A quantitative trend assessment of microcomputer growth in schools is illustrated in Figure 1. Microcomputer installations have grown linearly in the last 10 years (not exponentially as some might have predicted). A linear forecast then, of this present trend, would put us at 4.3 million installed PCs in schools by the year 2000. The significance of this is the *microdensity*, or the ratio of students to computer. Extrapolation of current trends suggests a microdensity of 10 by the turn of the century. This is factored over all grades, so at the middle and high school levels the ratio might be even lower.

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Networks in Schools

Network growth at the K-12 level is not a phenomenon that has a great deal of history. Several recent studies suggest there are more than 100,000 E-mail accounts on state educational networks (Abrams, 1993) and ap-

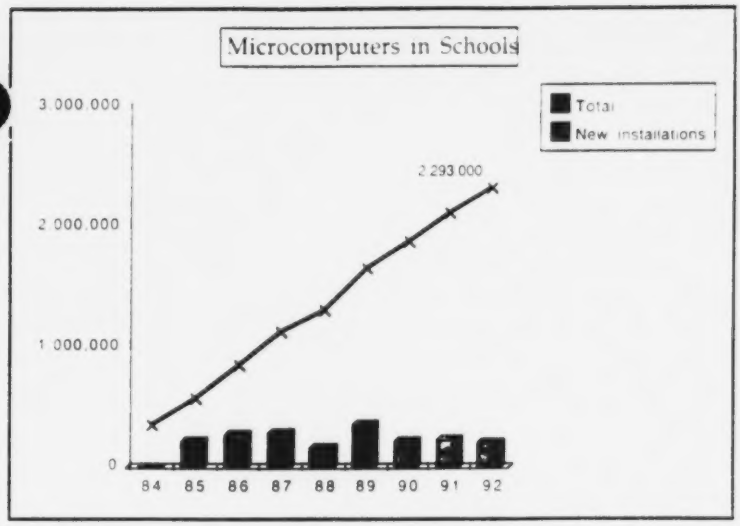

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Figure 1. Microcomputer Growth in Schools, 1984-1992
Source of data: Quality Education Data, Denver, CO

proximately 600,000 networking students in private and grassroots initiatives (Itzkan, 1992). Networking growth, however, unlike PCs, has been exponential. Usenet and Internet have seen growth rates of 50 to 100 percent annually. This is unprecedented. It is unlikely that networking at the K-12 level will grow as dramatically, but sustained levels of 20 to 30 percent do seem probable. The increasing movement for school, district, and statewide networks will fuel this growth. We may expect between approximately 3 and 5 million networking K-12 students in the U.S. by the end of the decade (Figure 2). At the upper end, that is more than 10% of the total U.S. public school student population.

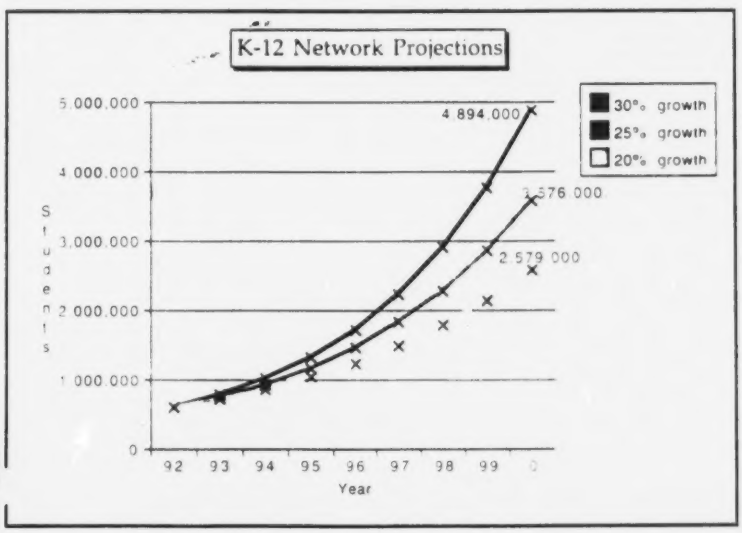

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Figure 2.Growth Projections for K-12 Networking

Diffusion Theory

With the previous techniques conclusive of the types of technologies and rates of growth, it now becomes essential to understand the processes of their diffusion. This is perhaps the most important part of a technological forecast—the qualitative, not the quantitative, element. To suppose that new technologies will continue to fit old models is a mistake. They do not.

Three Phases of Change

Typically, the impact of a new technology will pass through three phases. These are (1) a substitution phase, (2) a transition phase, and (3) a transformation phase (Figure 3). In the substitution phase, the technology replicates or automates existing practice. It does what people already know how to do, but better. It does not challenge existing paradigms. In the transition phase, new methodologies begin to evolve. The technology is now doing things that it wasn't necessarily brought in to do and is challenging old models. In the transformation phase, the technology has created completely new methodologies and proven the old ones obsolete. The task for which it was originally acquired, may no longer even be desired.

Perhaps nowhere is an illustration of this model more revealing than in regards to telecomputing itself. The evolution of computers, networking, and international networking or "global classroom activities" is strikingly demonstrative of the process. In each case, a technology is brought in to automate a previously existing practice, and inevitably begins to redefine the whole context of the operation. Figure 4 shows this in greater detail. The trends are shown passing through the three phases of social adoption.

Electronic Paper to Cognitive Agent

The transformation in the utilization of computers is most indicative. When computers were first introduced to schools, they acted essentially as electronic paper, replicating the drill and practice that was already familiar. Eventually new methodologies emerged, bringing with them instructional learning systems, *HyperCard* exploratory programs, and heated debates over implementation philosophy. This is the transition phase of instructional computing, and it describes, to a large extent, the current situation in many schools. Tomorrow's computers, however, will take us quite farther. Implementations of artificial intelligence and methodology taken from cognitive science (such as semantic networks) will allow computers to work on behalf of their user. They will recognize their speech, know what they are interested in, and facilitate exploratory learning through a world of contextually rich resources. Instructional methodologies will have to support variable time frame and individualized learning.

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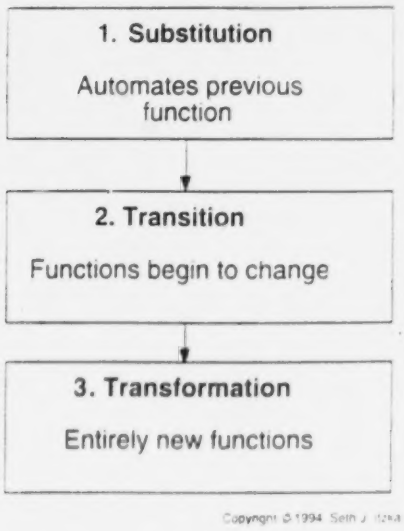

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Figure 3
Phases of Technological Diffusion

Colorful descriptors of such instructional tools are "cognitive agents" and "knowledge navigators." Gone will be the days of standard curricular models and drill and practice. The computer will have made obsolete the very methods it was first used to reinforce.

Automated Messaging to Instructional Landscape

The network is another prime example. When first installed, networks were forms of automated messaging. For many, this was exactly their justification—to speed the delivery of administrative forms. Today, that would be considered a primitive utilization. Networks are now a form of resource sharing. The linking of schools with libraries, colleges, and other institutions provides a value-added service to all players in the shared communications medium. In the future, networks may come to define the instructional landscape itself. The resources of a school, library, or even district may be measured by its "access to the network"—what services it is connected to and how many students can utilize them. We must consider the prospect that school districts themselves are on the road to extinction. Districts are based on geographic boundaries that are of increasingly diminished significance. Networks can readily create "virtual districts" with students, teachers, resources, and even administrators distributed around the world. In fact, many of the grassroots educational networks, such as KIDLINK, FrEdMail, and Academy 1 may already be considered autonomous *virtual districts*. The network which was brought in to automate communications within a district may, in fact, supersede it.

Networking growth has been exponential. Usenet and Internet have seen growth rates of 50 to 100 percent annually. This is unprecedented.

	PCs	Networking	Global Classroom
Substitution (new technology)	• Computers as electronic paper	• Networks as automated messaging	• Students as "pen pals"
Transition (new methodology)	• Priestly vs prophetic paradigm	• Resource sharing	• International collaboration
Transformation (new paradigm)	• Computers as cognitive agents	• Networks as educational landscape	• Students as "global citizens"

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Figure 4
Phases of Technological Diffusion for Three Trends

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The computer will have made obsolete the very methods it was first used to reinforce.

Pen Pals to Global Citizens

The last trend, that of international networking, or what is called *global classroom activities*, once again indicates the model of technological diffusion. At first international networking was predominantly used to create electronic "pen pals." Students wrote each other notes just as they would in any pen pal initiative. The international and speedy delivery made it exciting, but there were no methodologies to adequately exploit the technology. Today, global networking is clearly a means of academic collaboration. Students now work on international projects from all disciplines, such as science, foreign language, social studies, and global awareness. These programs, as innovative as they are, are still just stepping stones. International collaborative programs have become "real world" oriented, with students doing hands-on projects that draw from or make contributions to their schools and communities. Ultimately we may come to see that students are global citizens in a world society, and that international networking initiatives are not just school projects, but vehicles for the exercise of citizenship.

Considerations for Education

With the forecast tools now employed, the school administrator should have a better picture of what is coming. The opinions of the experts appear to be justified. An era of comprehensive instructional networking is on its way. The last step is to assess what this means for schools, districts, and classrooms.

Benefits for Instruction

For education in general, the effects can be quite beneficial. Appropriate use of the new capabilities can turn classrooms into living laboratories, fully connected and interactive with people and resources around the world. The following is a brief description of how curricular areas may be influenced.

- Language—foreign language classes will use voice and written E-mail to communicate with peers who are native speakers. Instead of listening to tapes and filling out worksheets, students will use the computer networks to listen and write to each other.
- Science—science classes will be augmented by interaction with experts who are doing research. Students will witness and communicate with those who are taking part in explorations, high energy physics, space walks, and so forth.
- Biology—biology classes will be linked to local hospitals and clinics. Students may witness operations or perform their own tests and experiments using advanced research facilities.
- Social Studies—social studies classes will use global networking as a form of group study on issues such as cultural awareness, politics, history, and current affairs. The global network will become an international student forum in which an endless variety of projects will take shape.

Administrative Considerations

On the administrative side, the growth of a network-based instructional environment raises a host of questions and issues, many of which may be quite troublesome. Although instructional opportunities will be advanced, administrative activities will be altered and redefined. We lack the space here to explore the issues in depth, but a brief list of some of the pressing questions raised is as follows:

1. What will happen to school libraries?
2. Will schools still need to require attendance?
3. Will smaller school districts be cut off from information highways?
4. Will computer networks make school districts obsolete?
5. Will schools and districts need to establish collaborative relationships with "information providers"?
6. Will companies like AT&T compete with schools and libraries?
7. Will the superintendents need to be a network administrators?

These questions and others like them, show the magnitude of what today's educational administrator must begin to consider. Though their answers lie in the future, it is already clear that to approach them, schools must begin to operate in an open and flexible networked environment. Information and resources will be abundant, accessible, and constantly updated. Curricular projects will be changing by the day, and it is quite possible that no two classes will ever do exactly the same experiment or use exactly the same material twice. Schools themselves must ultimately become learning institutions. ■

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James A. Levin and Cathy Thurston

Research Summary

Educational Electronic Networks

Virtual field trips to Central American rain forests, global grocery price comparisons, NASA Hubble telescope images, community Web pages. Electronic learning networks are changing what happens in the classroom. What does the research say about ways to make sure network learning is meaningful to students?

Electronic learning networks provide access to the riches of the world. Students in remote rural locations can reach the Library of Congress, classes in towns without museums can visit the Louvre, and students and teachers anywhere can communicate with content-area experts from around the world.

Networks also have made new forms of local and worldwide collaborative learning possible. They have helped to create writing communities (Bruce and Rubin 1993, Scardamalia et al. 1992), science communities (Learning Through Collaborative Visualization Project 1993, Newman and Goldman 1986–87, Raopp et al. 1993), mathematics communities (Klotz 1990), problem-solving communities (Levin et al. 1987), and teacher education communities (Levin et al. 1994, Thurston et al. 1996).

These electronic communities bring together students, teachers, and adults from outside the education arena. For example, students have worked in communities to analyze and predict weather, to exchange measurements of the sun's shadow to figure the circumference of the earth, and to develop new solutions to local problems based on similar approaches used in distant places. Teacher education students have worked in communities to find or develop, evaluate, and electronically publish curriculum resources.

Students do most of their work off the network, and in many cases off the computer. Network-based learning, unlike word processing or programming, does not require vast numbers of computers and unlimited connection time. It can motivate students to become involved in a wide range of learning activities.

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And the computer and network infrastructure can be expanded as needed to allow for ever more powerful uses.

Research on the uses of electronic networks often starts with the exploration of innovative uses. Researchers then develop conceptual frameworks for such uses and look at barriers that may lead to difficulties and failure. Educators can use this information to make decisions about networks in their own settings.

One set of studies focused on the InterCultural Learning Network (Levin et al. 1987), where students collaboratively tackled water shortage problems in their communities, engaged in network-based analyses of cultural differences in holiday celebrations around the world, and contributed to a network-based newswire. According to researchers, this kind of student writing is much more effective educationally than the electronic pen pal projects commonly advocated by network novices (Levin et al. 1989).

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Cohen and Riel (1989) reported that writing for remote peers over a network produced better quality writing than writing for the teacher. This "audience effect" of network-based interactions can provide a powerful context for learning in many different areas. Researchers have found similar effects in science (Cervantes 1993, Ruopp et al. 1993), mathematics (Thalathoti 1992), and social studies (Levin et al. 1989).

Sharing Information with Society

Electronic networks are highly interactive. Information can flow in many directions. The research suggests that in the long term, the most significant impact of networks on education may prove to be the flow of information from educational institutions to the rest of society.

Many recent curriculum reform efforts have focused on problem-based and project-based learning. Networks allow students and teachers to draw from many fields, not just from education. And networks allow students and teachers to share their findings with the world at large. Thus, student work—while primarily oriented toward optimizing learning—can have a secondary benefit beyond the immediate learning context.

For example, networked students helped design recreational activities for space station astronauts (Cervantes 1993, Levin 1992). They developed concepts for transforming everyday sports and for creating new sports. NASA professionals had not tackled this task because the space shuttle is too small for such activities.

Students can, as part of their learning activities, contact adults in their communities to identify problems and challenges. They can use networks to access resources anywhere in the world and make them available to community members. For example, students in California, Canada, Japan, Mexico, and Israel used a network to study a local water problem (Levin and Cohen 1985, Vaugn et al. 1988). They used local resources to learn the specifics of the problem and take actions. [illegible] Students in Minnesota [illegible] questions developed by local authorities in the distant students, who in turn asked their own experts. They exchanged information, and they analyzed it to identify actions that local authorities had not yet considered.

Barriers to Using Electronic Networks

Much of the research to date has focused on overcoming the difficulties of using networks successfully in education. These barriers include lack of access and appropriate infrastructure, separation of telecommunications from the curriculum, lack of support for teachers attempting to work with innovative approaches, and lack of teacher expertise in telecommunications.

Infrastructure and access. A number of studies indicate that it is important for teachers to have equipment in their classrooms (Harris 1994, Levin 1995, U.S. Office of Technology Assessment 1995). The Apple Classroom of Tomorrow research indicates that teachers should return from training sessions to classrooms equipped with the hardware and software on which they received their training (Ringstaff and Yocum 1994). Ideally, they should have access to telecommunications equipment at home and at school (Harris 1994).

Infrastructure—which includes wiring, modems or high-speed connections, and computer hardware and software—is a critical component of an effective network. Current estimates are

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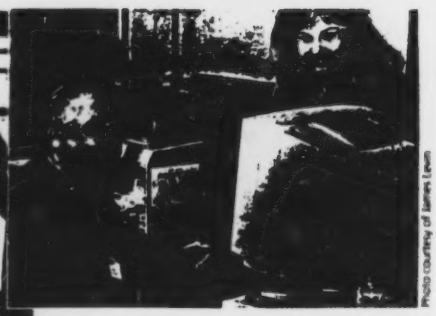

Photo courtesy of James Levin

that only 9 percent of the nation's classrooms are connected to the Internet (West 1996). In our experience with the Teaching Teleapprenticeships model, student teachers emphasized the importance not only of having hands-on training, but also of being "hooked up" or "wired" in their own classroom (Thurston et al. 1996).

Telecommunications and curriculum. A second barrier to effective implementation of networks is the gap between network use and the curriculum. Studies show that networks are most effective when they are tied to the curriculum (Levin 1995, Thurston et al. 1996). Training is essential if teachers are to see telecommunications as a means to an end, not as an end in itself. For example, a high school French teacher developed a project where a large number of sites contributed recipes via the Internet. Her students then translated the recipes from French into English, which involved math as well as language skills. Then, they used desktop publishing software to create and illustrate a cookbook based on the project.

Lack of support. Another barrier to teacher implementation of networks is a lack of technical and/or administrative support. Very few schools have a full-time, on-site computer coordinator available to help teachers. *The Learning Connection* (Benton Foundation 1995) indicates that 60 percent of schools have no one to help, and it estimates that only 6 percent of elementary schools and 3 percent of high schools have a full-time computer coordinator.

The newly released Carnegie Report, *Breaking Ranks* (National Association of Secondary School Principals 1996), says such support is critical. In its "Priorities for Renewal," the report recommends that "every high school designate a technology resource person to provide technical assistance and to consult with staff to assist them in finding the people, information, and materials that they need to make best use of technology." Administrative support is as important as technical support (Harris 1994, Levin 1995, Ringstaff and Yocum 1994). In fact, the Apple Classroom studies show that the principal has a key role to play. The principal can control release time, provide access to hardware and software, promote team teaching or interdisciplinary study, and acknowledge efforts and provide recognition.

Lack of effective training. Research shows that many teachers have little or no experience with telecommunications or with technology in general (Benton Foundation 1995, Thurston 1990, U.S. Office of Technology Assessment 1995). In fact, lack of teacher expertise is probably one of the most significant obstacles to the effective implementation of networks. Teachers need appropriate infrastructure and access, opportunities to integrate technology into the curriculum, and technical and administrative support; but they also need effective training. And effective training requires hands-on experience and follow-up support (Benton Foundation 1995, Ringstaff and Yocum 1994).

Many experts believe it is a mistake to mandate telecommunications training for all teachers. Schools should support and recognize those teachers who are ready to move forward and learn (Foa et al. 1996, Harris 1994). Training should incorporate modeling or coaching in effective uses of technology (Benton Foundation 1995, Harris 1994, Ringstaff and Yocum 1994). The training should include face-

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Much of the research to date has focused on overcoming the difficulties of using networks successfully in education.

to-face sessions followed by practice, then a return to follow-up coaching (Harris 1994). Teachers should work in pairs or small groups (Harris 1994, Ringstaff and Yocum 1994), so they have peer support when they return to their classrooms.

Studies show that districts should allocate 30–40 percent of their technology budget to teacher training (Benton Foundation 1995, Foa et al. 1996, Marshall 1995, U.S. Advisory Council on the National Information Infrastructure 1996, U.S. Office of Technology Assessment 1995). Typically, however, school districts allocate less than 15 percent for training (Benton Foundation 1995), and many have no budget at all.

Changing the Nature of Teaching and Learning

In summary, research has shown that the use of telecommunications in the classroom has the potential to change the nature of teaching and learning (Foa et al. 1996, Means 1994, Wilson et al. 1995). It can shift the focus from whole-group to small-group interaction; it can mark a shift from lecture to coaching; and it can enable teachers to do more one-on-one work with students. It can help shift the focus from test performance assessment to assessment based on products and progress (Wilson et al. 1995). And it can encourage teamwork, collaborative inquiry, and individualized instruction (Means 1994, U.S. Office of Technology Assessment 1995). ■

Using Networks Successfully

- The "audience effect" of network-based interactions can provide a powerful context for learning (Cervantes 1993, Ruopp et al. 1993, Thalathoti 1992, Levin et al. 1989).
- Teachers need to have telecommunications equipment in their classrooms (Harris 1994, Levin 1995, U.S. Office of Technology Assessment 1995).
- Networks are most effective when they are tied to the curriculum (Levin 1995, Thurston et al. 1996).
- Technical and administrative support is critical if teachers are to implement networks (National Association of Secondary School Principals 1996, Harris 1994, Levin 1995, Ringstaff and Yocum 1994).
- Teachers need appropriate and effective training, including hands-on experience and follow-up support (Benton Foundation 1995, Ringstaff and Yocum 1994).
- Districts should allocate 30–40 percent of their technology budget to teacher training (Benton Foundation 1995, Foa et al. 1996, Marshall 1995, U.S. Advisory Council on the National Information Infrastructure 1996, U.S. Office of Technology Assessment 1995).

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The Educator's *Ultimate* World Wide Web Hotlist

By Odvard Egil Dyrli

The World Wide Web offers plenty for you and your students, but do you know where to find what you need? Here, T&L's telecommunications columnist shares his "ultimate hotlist" for enriching and extending your curriculum.

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Imagine this: You're an American history teacher, trying to awaken your students to the devastation caused by the Civil War. Wouldn't it be great, you think, if the soldiers could speak directly to the students. What you really need is some letters home written by the men who served....

Those letters are a click away on the Internet's World Wide Web. After only a few short years, the Web has become the premier place online for finding multimedia resources and connecting students to real-world events. Teachers have discovered that the Web makes possible new levels of individualization, and encourages collaborations that take students far beyond the classroom (see "Surfing the World Wide Web to Education Hot-Spots," *Technology & Learning*, October, 1995).

But what's needed is a guide that points the way to the extensive resources already available online—the documents, photographs, maps, video clips, sound bites, references, and teaching materials for every level and content area. That's where this article comes in. It's called the educator's "ultimate" hotlist because it represents a comprehensive compendium of online educational resources including lesson plan collections; curriculum resources from schools, colleges, government agencies, and commercial organizations; cooperative online projects; and Web-based libraries, museums, and communications media. Plus, we've included the URLs of powerful tools you can use to search the Web on your own. We hope you will use this article as a continuing reference.

Sites, of course, can appear, move, or disappear suddenly. Fortunately, many valuable educational materials are linked to online "centers" that are comparatively stable. To ensure accuracy, all addresses have been verified, and the sites were selected based on the quality of their offerings.

Lesson Plan Sources

While you can find lesson plans at a variety of Web sites, including some listed in other categories, the following locations have particularly strong lesson plan collections.

- The AskERIC Virtual Library (http://ericir.syr.edu)
- Columbia Education Center's Mini Lessons (http://youth.net/cec/cec.html)
- Connections+ (http://www.mcrel.org/connect/plus)
- EE-Link, Environmental Education on the Internet (http://nceet.snre.umich.edu)

Search Engines

Search engines scour the Web based on content words or phrases that you specify. Each of the choices below has unique search area strengths, so it is good to try several.

- Alta Vista (http://altavista.digital.com)
- Excite (http://www.excite.com)
- InfoSeek (http://www.infoseek.com)
- Lycos (http://www.lycos.com)
- WebCrawler (http://www.webcrawler.com)
- clnet search.com (http://www.search.com)
- MetaCrawler (http://www.metacrawler.com)

Information Indexes

Information indexes use topic menus and submenus to narrow searches until you find resources of potential interest. Yahoo is by far the most comprehensive and well-known information index, but there are other options such as Kids Web, which is tailored for students.

- Yahoo (http://www.yahoo.com)
- Yanoff's Internet Services List (http://www.spectracom.com/islist)
- Cool School Tools (http://www.bham.lib.al.us/cooltools)
- Kids Web (http://www.npac.syr.edu/textbook/kidsweb)
- Yahooligans, The Web Guide for Kids (http://www.yahooligans.com)

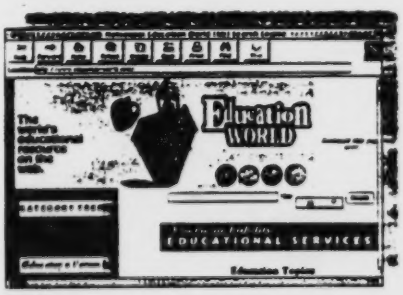
Curriculum Resource Centers

There are many curriculum centers maintained online by various organizations including professional associations, foundations, government agencies, colleges, and universities (see the next two sections for centers maintained by K-12 schools and commercial companies). Some of these are collections of general educational resources, but others are specialized by content area or teaching level.

The curriculum centers listed below are grouped by general content area emphases—note that several sites combine math and science resources—or may contain links to Web sites of value to a broad range of K-12 teachers. Those listed under "general curriculum" include resources in several content areas, and are usually divided by subject.

General Curriculum

- Curricular Resources and Networking Projects (http://www.ed.gov/EdRes/EdCurric.html)
- Education World (http://www.education-world.com)

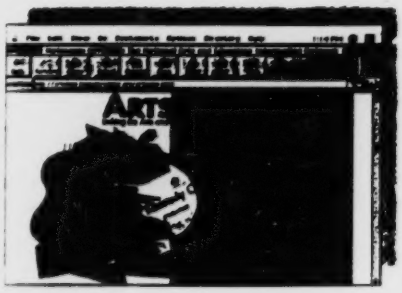


Education World

- EdWeb (http://edweb.cnidr.org)
- Internet Connections (http://mcrel.org/connect)
- LiveText Educational Resources (http://www.ilt.columbia.edu/k12/livetext)
- The Schoolhouse (http://www.nwrel.org/school_house)
- Web Sites and Resources for Teachers (http://www.csun.edu/~vceed009)
- World Education Exchange (http://www.hamline.edu/~kjmaier)

The Arts

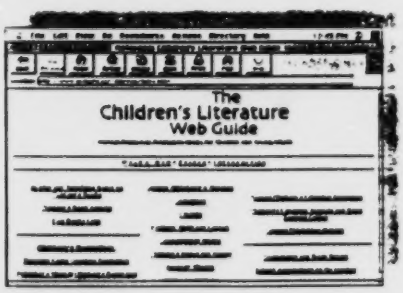
- ArtsEdge (http://artsedge.kennedy-center.org/artsedge.html)
- ArtsEdNet, an online service for K-12 arts education (http://www.artsednet.getty.edu)
- Dance Directory (http://www.cyberspace.com/vandehey/dance.html)
- Music Education Online (http://www.geocities.com/Athens/2405/index.html)
- The Music Educators Home Page (http://www.athenet.net/~wslow)
- The Puppetry Home Page (http://www-leland.stanford.edu/~roseage/puppetry/puppetry.html)



ArtsEdge

Language Arts and Literature:

- The On-Line Books Page (http://www.cs.cmu.edu/Web/books.html)
- The Children's Literature Web Guide (http://www.ucalgary.ca/~dkbrown/index.html)
- The Complete Works of William Shakespeare (http://the-tech.mit.edu/Shakespeare/works.html)
- Multicultural Book Review (http://www.isomedia.com/homes/jmele/homepage.html)
- Poetry (http://english-www.hss.cmu.edu/poetry)
- Resources for English Teachers (http://nickel.ucs.indiana.edu/~lwolfgra/english.html)



The Children's Literature Web Guide

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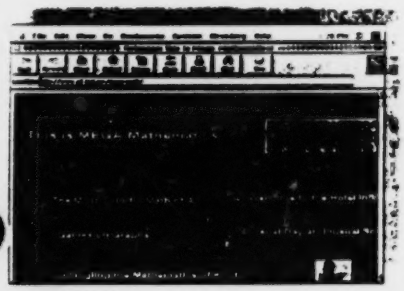
Mathematics

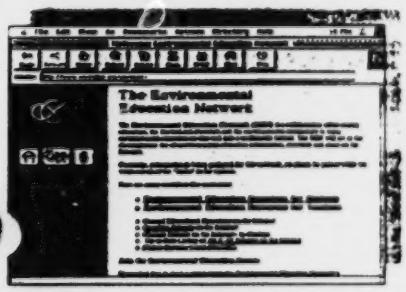
- Ask Dr. Math (http://forum.swarthmore.edu/dr.math/dr-math.html)
- Calculators On-Line Center (http://www-sci.lib.uci.edu/HSG/RefCalculators.html)
- Cornell Math and Science Gateway for High School (http://www.tc.cornell.edu/Edu/MathSciGateway)
- The Geometry Center (http://www.geom.umn.edu)
- The Math Forum (http://forum.swarthmore.edu)
- MegaMath (http://www.c3.lanl.gov/mega-math)



MegaMath

Science

- Eisenhower National Clearinghouse (http://www.enc.org)
- The Environmental Education Network (http://www.envirolink.org/enviroed)
- Health Resources (http://www.kent.wednet.edu/curriculum/health/health.html)
- SciEd: Science and Mathematics Education Resources (http://www-hpcc.astro.washington.edu/scied/science.html)



The Environmental Education Network

- Science Learning Network (http://www.sln.org)
- Space Educators' Handbook (http://tommy.jsc.nasa.gov/~woodfill/SPACEED/SEHHTML/seh.html)

Social Studies

- American History Archive Project (http://www.ilt.columbia.edu/k12/history/aha.html)
- History/Social Studies Web Site for K-12 Teachers (http://execpc.com/~dboals/boals.html)
- Lesson Plans and Resources for Social Studies Teachers (http://www.csun.edu/~hcedu013/index.html)
- Online Resources (http://socialstudies.com/online.html)
- Social Studies (http://www.kent.wednet.edu/curriculum/soc_studies/soc_studies.html)
- Social Studies Sources (http://www.halcyon.com/howlevin/social.studies.html)

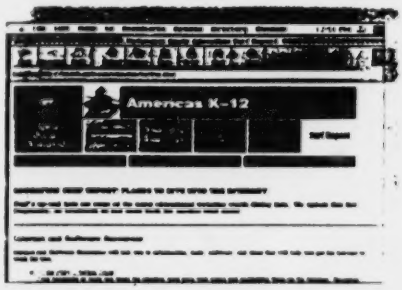
K-12 School Curriculum Collections

Growing numbers of K-12 educators are sharing their collections of links to Web resources, many of which are maintained as "labors of love" for the common professional good. The following are noteworthy examples.

- Armadillo's K-12 WWW Resources (http://chico.rice.edu/armadillo/Rice/K12resources.html)
- Carrie's Sites for Educators (http://www.mtjeff.com/~bodenst/page5.html)
- Integrating the Internet (http://www.indirect.com/www/dhixson)
- Jan's Favorite K-12 Resources & Projects (http://badger.state.wi.us/agencies/dpi/www/jans_bkm.html)
- Lane's Homepage (http://www.ebicom.net/~lane)
- Kathy Schrock's Guide for Educators (http://www.capecod.net/Wixon/wixon.htm)
- Vose School Education Resources Page (http://www.teleport.com/~vincer)
- Web Site for Busy Teachers (http://www.ceismc.gatech.edu/BusyT)

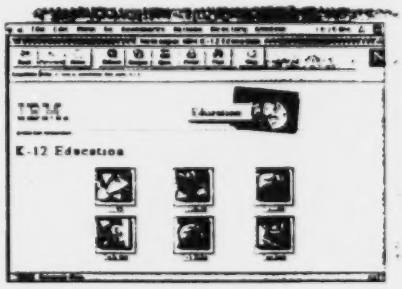
Commercial Curriculum Collections

Many companies that provide goods and services to schools now offer links to curriculum resources—their own and others—at their Web locations.



Apple Education Worldwide Surf Report

- Apple Education Worldwide Surf Report (http://ed.info.apple.com/education/surfrep.html)
- Cisco's Virtual Schoolhouse (http://sunsite.unc.edu/cisco/schoolhouse.html)
- Classroom Connect on the Web (http://www.classroom.net/cgi/rotm/eduFind.html)
- Educational Software Institute Online (http://www.edsoft.com/esi)
- Discovery Channel School (http://school.discovery.com)
- Global Schoolhouse (GSH) (http://www.gsh.org)
- Global Network Navigator (GNN) K-12 Education (http://gnn.com/gnn/wic/wics/ed.teach.html)
- Houghton Mifflin Education Place (http://www.eduplace.com)
- IBM K-12 Education (http://www.solutions.ibm.com/k12)
- Internet Learning Sites (http://www



IBM K-12 Education

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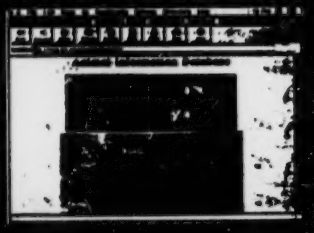
What Makes the Hot?

The following examples, drawn from the sites in this article, illustrate the range of high-quality materials available to enhance your curriculum.

- **23 Peaks Expedition** (http://www.23peaks.com). Through journal entries and photographs, follow a team of explorers as they climb the highest peak of each nation in North, Central, and South America.
- **Benjamin Franklin: Glimpses of the Man** (http://sln.fi.edu/franklin). Review the work of one of our Founding Fathers—as a scientist, inventor, statesman, printer, philosopher, musician, and economist.
- **Cap Web, A Guide to the U.S. Congress** (http://policy.net/capweb/congress.html). Explore our government via links to the Senate, House of Representatives, and the Library of Congress, with additional resources on the executive and judicial branches of the federal government.
- **Electronic Field Trip to the United Nations** (http://www.pbs.org/tal/un). Tour the UN at its half-century mark, with background history, and the "UN in action"—major achievements, world trouble spots, daily press summaries—with classroom activities and links to related resources.
- **Gallery of Interactive Geometry** (http://www.geom.umn.edu/apps). Put theory into action at this site where math decisions affect geometric models on the screen.
- **Letters From an Iowa Soldier in the Civil War** (http://www.ucsc.edu/civil-war-letters/home.html). Read three years' worth of letters written by an army clerk describing such details of the war and living conditions in Union camps—with maps and links to related Civil War sites.

- **The Nine Planets** (http://seds.lpl.arizona.edu/nineplanets/nineplanets/nineplanets.html). The sky's no limit at this illustrated tour of the planets and moons of the solar system, with links to sites on planetary research.
- **The Pelagic Shark Research Foundation** (http://www.ucgraf.com/pelagic/index.html). "Everything you want to know about sharks, and more" you'll find right here: current research on their biology and history, plus links to shark sites throughout the world.
- **The New South Polar Times** (http://205.174.118.254/nspt.html). "Discover the Antarctic through photographs and experiences shared by members of the Amundsen-Scott South Polar Station.
- **Sea World/Busch Gardens Animal Information Database** (http://www.bev.net/education/SeaWorld). Talk with the animals—or at least learn more about them—at this site, with links to related educational resources and information on zoological careers.
- **Volcano World** (http://volcano.und.nodak.edu). An explosion of volcano-related information, this site lets you learn about different types of volcanoes, visit volcanic parks, and study active volcanoes throughout the world.
- **WeatherNet** (http://cirrus.sprl.umich.edu/wxnet). All the weather information you need is here, including thousands of forecasts and images and links to weather maps, storm centers, and live weather cameras.



pierian.com/oasis/gazette/gazette.html)
- Latitude28 Schoolhouse (http://www.indy.opennet.com/schoolhouse)
- Macmillan/McGraw-Hill Schoolhouse (http://www.mmhschool.com)
- Pitsco Technology Education (http://www.pitsco.com/wel.html)
- School.Net (http://k12.school.net)
- *Technology & Learning* (http://www.techlearning.com)

Sources for Online K-12 Projects

Cooperative projects give students the opportunity to study a topic with participants from around the world—and hone telecommunications skills at the same time. The following are the major Web sites for finding and proposing online educational projects of all sorts.

- Academy One/National Public Telecomputing Network (http://www.nptn.org/cyber.serv/AOneP)
- Adventure Online (http://www.adventureonline.com)
- Electronic Emissary Project (http://www.tapr.org/emissary)
- Electronic Schoolhouse (ESH) (http://town.pvt.k12.ca.us/Collaborations/e-school/e-school.html)
- Global SchoolNet Foundation (GSN)

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Adventure Online

(http://www.gsn.org)

- Hilites (http://www.gsh.org/tch2tch/hilites.htm)
- Intercultural E-Mail Classroom Connections (IECC) Projects (http://www.stolaf.edu/network/iecc)
- International Education and Resource Network (I*EARN) (http://www.iearn.org/iearn)
- Internet Projects Registry (http://www.gsn.org/gsn/proj/index.html)
- KIDLINK/KIDPROJ (http://www.kidlink.org/KIDPROJ)
- Online Class (http://www.usinternet.com/onlineclass)
- Quest, The NASA K-12 Internet Initiative Page (http://quest.arc.nasa.gov)
- NASA SpaceLink (http://www.spacelink.msfc.nasa.gov)
- NASA SeaWiFS Projects—including the Jason and Ocean Planet Projects (http://seawifs.gsfc.nasa.gov)

Libraries and Museums

The Web allows teachers and students to visit libraries, museums, and exhibits throughout the world, and do research electronically.

- Exploratorium ExploraNet (http://www.exploratorium.edu)
- Expo, WWW Exhibit Organization (http://sunsite.unc.edu/expo)
- Franklin Institute Science Museum (http://www.fi.edu)
- Hands On Children's Museum (http://www.win.com/~deltapac/hocm.html)
- Hands-on Science Centers Worldwide (http://www.cs.cmu.edu/~mwm/sci.html)
- Internet Public Library (http://ipl.sils.umich.edu)
- Library of Congress (http://lcweb.loc.gov)
- National Air and Space Museum (http://www.nasm.edu)
- On-Line Exhibitions and Images—note that the address is expressed numerically (http://155.187.10.12/fun/exhibits.html)

Planet Earth Home Page (http://www.nosc.mil/planet_earth/info.html)

The Smithsonian (http://www.si.edu)

- United States Holocaust Memorial Museum (http://www.ushmm.org)
- Virtual Tourist (http://www.vtourist.com)
- WebMuseum Network (http://sunsite.unc.edu/louvre)

Library of Congress

Communications Media

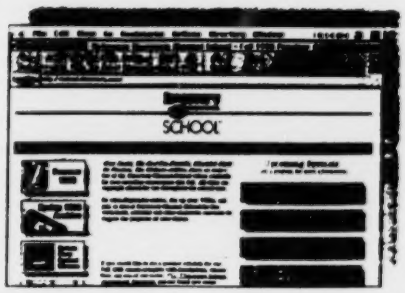
Valuable channels for investigating topics in depth are the online links to communications media including book publishers, magazines, newspapers, and television programs.

- CNN Interactive (http://www.cnn.com)
- Discovery Channel (http://www.discovery.com)
- Hotlinks (online newspapers) (http://www.naa.org/hot)
- National Geographic Society (http://www.nationalgeographic.com)
- PBS Online (http://www.pbs.org)
- Publishers' Catalogs Home Page (http://www.lights.com/publisher)
- Books A to Z (http://www.booksatoz.com)
- The Nando Times (http://www2.nando.net)

Especially for Kids

The following sites were developed specifically for children, and offer a variety of educational resources, as well as recreational materials including interactive stories, games, and puzzles.

- Berit's Best Sites for Children (http://www.cochran.com/theosite/KSites.html)



Discovery Channel

- Book Nook (http://www.schoolnet.ca/english/arts/lit/booknook)
- Cool Places for Kids (http://www.alaska.net/~steel/coolpls.html)
- Global Show-n-Tell (http://www.telenaut.com/gst)
- KidNews (http://www.vsa.cape.com/~powens/Kidnews.html)
- Kid Pub (http://www.en-garde.com/kidpub)
- Kids on Campus (http://www.tc.cornell.edu/Kids.on.Campus/WWWDemo)
- MidLink Magazine (http://longwood.cs.ucf.edu:80/~MidLink)
- The Kids on the Web (http://www.zen.org/~brendan/kids.html)
- The Kids Web (http://www.lws.com/kidsweb/links.htm)
- Uncle Bob's Kids' Page (http://gagme.wwa.com/~boba/kidsi.html)

Schools on the Web

A valuable way to see how K-12 teachers are using online resources for assignments, projects, teaching units, and even courses, is to visit school Web sites. The following indexes will link you directly to schools on the Web throughout the United States and abroad.

- HotList of K-12 Internet School Sites (http://www.sendit.nodak.edu/k12)
- School.Net Navigator (http://school.net/go/go.g_na_us.html)
- Web66—Schools on the Web (http://web66.coled.umn.edu)

■ *Odvard Egil Dyrli, a columnist and contributing editor for* Technology & Learning, *is Professor Emeritus of Education at The University of Connecticut, and an education technology consultant nationwide (DYRLI@UCONNVM.UCONN.EDU.)*

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Find the Perfect Technology Coordinator

INTERVIEWING TO THE FULLEST

By Richard Alan Smith

Useful interview questions for candidates for the tech-coordinator position in your school or district. Current and prospective tech coordinators can use these questions as a self-study checklist.

As school districts increase their levels of technology acquisition and use, the problem of coordinating of these resources becomes more prominent. Some districts seek to solve the problem by assigning technology-coordination responsibilities to a talented computer-using teacher at each school site. Other districts simply add tech-coordination tasks to the responsibilities of an administrator such as the assistant superintendent for curriculum. Most districts, however create a technology-coordinator position and begin the recruitment process to find the best possible person for the job.

In all situations, care must be taken to make certain that the person selected has the time to do the job and enough knowledge about instructional computing to provide adequate leadership. How can you identify the right person for the difficult job of coordinating the use of technology in your district?

The most important step in the recruitment process is the interview. It is at this point that you have the opportunity to probe the level of professional knowledge that each candidate has. Even if your district plans to assign tech-coordination responsibilities to an administrator in another area, such as curriculum, it is a good idea to make certain that the person is prepared to coordinate the spending of thousands of dollars of technology money.

You will want to learn about each candidate's level of knowledge and experience in four different areas:

1. Technical expertise.
2. Understanding of technology use in the instructional environment.
3. Professional development.
4. Internet knowledge and experience.

The interview questions on the following pages present a set of guidelines that we have followed in the Houston Independent School District to hire district-level instructional technology coordinators, an Internet coordinator, and an Internet specialist. Each question is designed to separate basic users of technology from those candidates who have taken an active interest in the study of instructional technology and have become professionals in the field (or are one step away from doing so). Several of these questions presented challenges to candidates already employed as tech coordinators in other districts because the questions probe deeper than the candidate's ability to troubleshoot computer installations; they also cover the identification of professional resources in instructional technology.

Although these questions will not apply to every situation, they will get your interviewing committee through most instructional technology interview requirements and help improve the committee's chances of making the right choice.

Richard Alan Smith, Director of Instructional Technology, Houston Independent School District, Division of Instructional Technology, 1305 Benson Street, Houston, TX 77020; ras@tenet.edu

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INTERVIEW QUESTIONS

These questions will help your interviewing committee assess each technology coordinator candidate's level of knowledge and experience in the main activities that will be required of him or her. Although this list of questions is not exhaustive, it serves as a good starting point because it gives questions that assess both technical skills and professional experience.

TECHNICAL EXPERTISE

Compare and contrast the Macintosh and Windows operating systems.

If you have multiple operating systems in your school, you will want to know how familiar the candidate is with the various systems. Although the candidate can learn additional operating systems, you might want to select a candidate who can begin work with minimal start-up time.

What are the typical types of repair problems likely to be exhibited by computers and peripherals? How would you deal with them?

Computer repairs are a fact of life. Responses to this question will enable you to know if the candidate can identify common repair problems, and may also enable you to discern whether the candidate can differentiate between hardware and software problems. You should also get an idea of what kind of repairs the candidate will be able to handle and the candidate's opinion about the advantages of doing repairs at a district-based facility compared to sending the equipment to an outside contractor.

What are the key elements of a school-based computer network?

Depending on how the candidate responds, you will get a good idea of how technical his or her level of knowledge is with reference to computer networks. For instance, if the candidate only discusses concepts such as networking as a vehicle for the distribution of high-quality software and makes no reference to servers, network cards, cabling, hubs, network operating systems and their features, and so on, you should expect a minimal level of network technical expertise.

The implementation of large-scale instructional technology projects takes a great deal of organization. What do you identify as the key steps in large-scale technology project implementation?

There is a big difference between successfully using computers in the classroom as a teacher and having the knowledge and experience necessary to coordinate the purchase and installation of hundreds of thousands of dollars worth of computer equipment and knowing how to provide teachers with the appropriate technology. You should be listening for key words in the candidate's response such as budget, timetable, bids, requisitions, teacher input, and training.

What are the elements of a well-written proposal for external technology funding?

A knowledgeable response to this question is important if you expect the computer coordinator to simplify the process of finding and obtaining external funding for the use of technology in your district. Listen for phrases such as "get to the point quickly," "base your project on research or previous successful projects," and "match the budget to the project description section." Also, look for knowledge of key proposal sections such as needs assessment, goals and objectives, capabilities, project description, and evaluation.

TECHNOLOGY USE IN THE INSTRUCTIONAL ENVIRONMENT

When teaching teachers to use computer laboratories, what are some of the key points of laboratory use and organization that you rank as most important for them to learn?

The candidate should answer this question without hesitation, in a detailed manner, and, of course, in a way that will let you know whether the candidate can help teachers make the best use of computer labs.

When helping teachers use technology in the classroom, what are some of the key points of technology use and classroom organization that you rank as most important for them to learn?

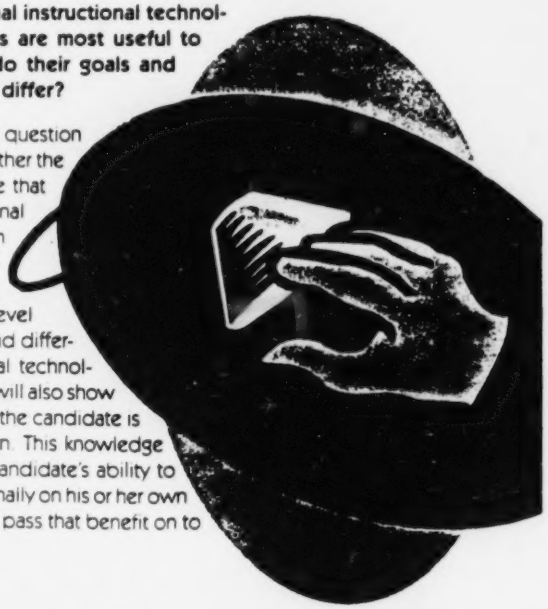
Computer labs are all well and good, but to have a well-rounded program, computers should be placed in the classroom either in addition to or in lieu of labs. In either scenario, the person selected to lead the process should be as knowledgeable about the use of classroom-based computers as he or she is about the use of lab-based computers.

Name some quality instructional software programs. What are their leading characteristics?

This question will identify how much the candidate knows about instructional software. It can be amazing how many candidates struggle to come up with the names of two or three software packages, frequently naming Microsoft Works or other business applications instead of programs like Reader Rabbit.

PROFESSIONAL DEVELOPMENT

Which professional instructional technology organizations are most useful to teachers? How do their goals and target audiences differ?



The answer to this question will show you whether the candidate is aware that there is a professional support structure in the field of instructional computing. The candidate's level of ability to rank and differentiate instructional technology organizations will also show you how involved the candidate is with the profession. This knowledge will indicate the candidate's ability to improve professionally on his or her own knowledge and to pass that benefit on to teachers.

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INTERVIEW QUESTIONS

Have you made instructional technology presentations at conferences or had instructional technology articles published? If so, at which conferences and in which journals did your work appear? What topics did you cover?

The candidate's response to this question will show you how active he or she is in the field of instructional computing. From the topics of the articles published or presentations made you will be able to find out what the candidate considers to be his or her particular strengths.

Which magazines and journals do you think would be most helpful to teachers as sources of instructional technology project information and research findings?

Although the candidate may not be active in professional organizations, make presentations at conferences, or write articles, he or she should be able to identify magazines or journals that provide a constant source of new instructional computing information. An in-depth response to this question is important because it will indicate that the candidate is capable, at least on some level, of professional development on his or her own, which can then be passed on to teachers.

INTERNET KNOWLEDGE AND EXPERIENCE

What is the Internet and how can it be used to improve education?

Although many people have a vague idea of what the Internet is, few understand its underlying structure. The candidate should be able to identify the Internet as a network of networks that allows people in various sites around the world to communicate as if they were on a local area network. The candidate should also be able to convey that the Internet can be used for such things as sending and receiving e-mail, logging on to remote computers, sending and retrieving files, and looking for information using FTP, Gopher, and the World Wide Web.

But, just knowing what the Internet is won't be enough. The candidate should also demonstrate that he or she knows how it can be used to improve instruction. Look for evidence that the candidate realizes that the Internet can be used to increase access to instructional resources, help with teachers' professional development, and enable students to communicate with students from diverse cultures around the world.

What is the World Wide Web?

This is another question designed to differentiate a candidate at the user level of Internet knowledge from a candidate with a deeper understanding of what is being used. The response should indicate that the candidate knows that the Web is a distributed system of information that is entered using a graphical user interface.

Describe the relationship of HTML to the World Wide Web.

If the candidate knows that HTML is a programming language that enables authors to embed links to other documents on the Web in a standard fashion and goes on to describe the authoring process, you will know that the candidate's level of Internet knowledge goes beyond the level of casual user.

Describe your involvement with an instructional Internet project.

The answer to this question will let you know if your candidate has any hands-on experience using the Internet for instruction and give you an idea of the candidate's depth of experience with the Internet.

Name some Internet services or sites that would be useful to teachers and students.

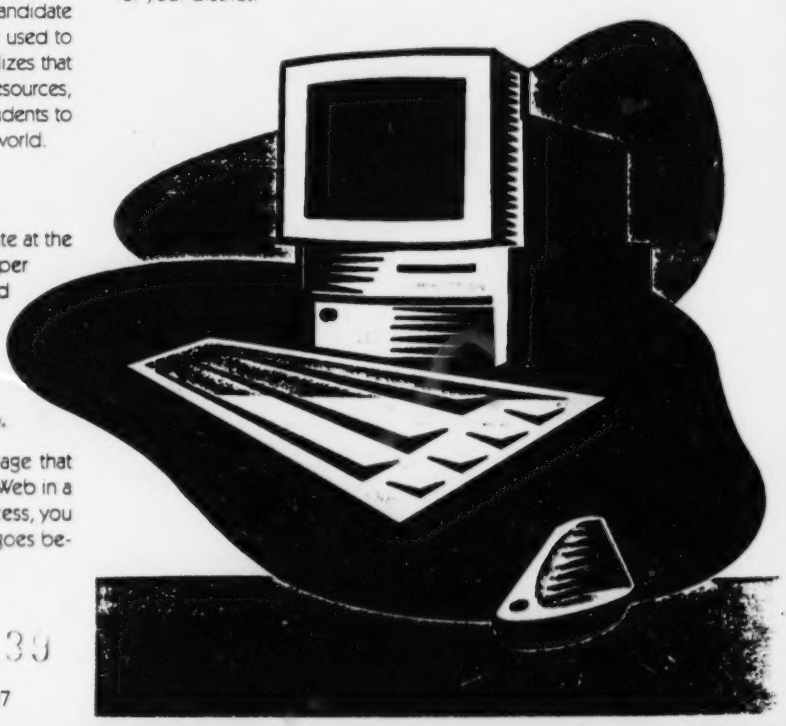
Technical knowledge of the Internet is one thing; knowing where to go for information that will be useful to teachers and students is something else, and, for our purposes, it is equally important. Typical knowledgeable responses would suggests sites such as the AskERIC Virtual Library, KIDLINK, Learning Connection, NASA Educational Resources, and World Wide Web Armadillo.

How would you increase the number of teachers and students who use the Internet for instruction and learning?

Here we are looking for the "vision thing." Use of the Internet and the Web for the improvement of instruction is not necessarily intuitive for teachers (and many administrators for that matter). The candidate should be able to provide a sense of how to impart the importance of the Internet to teachers and be able to talk intelligently about the hardware, software, networks, and phone lines necessary to make it work.

Describe the steps you would take to ensure that students do not access material on the Internet that is inappropriate for their use because of the material's sexual or political content.

The candidate's response to this question will let you know whether he or she has thought about the subject at all and if he or she can suggest practical steps. The candidate should indicate that he or she would review other districts' policies before suggesting a new policy for your district.



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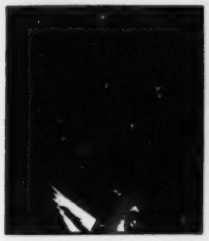
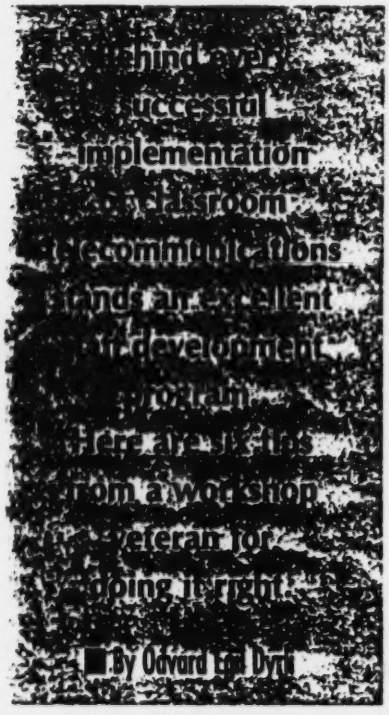


Essentials for Telecommunications Staff Development



By Odvard Egil Dyrli

If you've ever been to a staff development workshop concerned with online skills, you may well have encountered presentations by "online acrobats" who dazzle with rapid-fire screen calisthenics: "First I click here, then there. I make this menu choice. To answer this dialogue box, click there, then here." While such a presentation can be fun to watch, it rarely produces lasting results, and may even turn off participants who feel intimidated by it all.

However, staff development is crucial to the success of telecommunications in schools, and needs to be done right. No matter how powerful the hardware in your school, or how fast your connection to the Internet, teachers need proper training to use these exciting resources to their best advantage. But while it may seem expensive to do staff development well, in the long run it will cost more to do it poorly, and much more to skip it altogether.

ESSENTIAL ELEMENTS

In recent years I have conducted many professional development programs, in formats ranging from hour-long and one-day presentations to full-semester courses. I have also participated in my share of workshops developed by others. As a result, I recommend the following key elements for successful staff development:

1. Offer a Variety of Options. Ideally, telecommunications staff development should continue throughout the year, in contexts that include large-group presentations, curriculum-specific small-group workshops, and individual online sessions. Additionally, teachers can extend their skills if optional instructional experiences and materials are available. Area conferences and workshops fit the bill, as do print and multimedia materials.

2. Emphasize Skill Development. While inspirational workshops have their place, teachers will benefit more from workshops that focus on learning practical techniques and mastering sometimes arcane online routines. Examples include signing on to education-oriented discussion groups, downloading files, and participating in online collaborative projects.

3. Provide Hands-On Experiences. Staff development presentations should

(continued on page 8)

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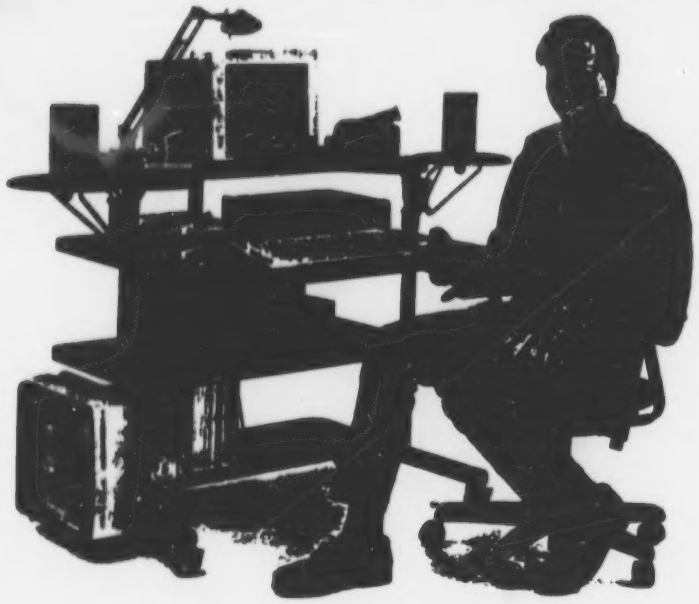

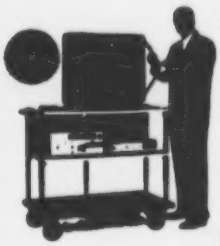

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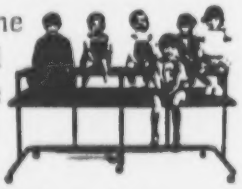

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include live online demonstrations, and model how to deal with problems that can arise. However, teachers also need opportunities to try out for themselves what has just been shown, whether in classrooms or in small-group lab settings.

4. Tailor Programs to Local Realities. This is particularly important when using outside presenters. Teachers will feel frustrated learning to do things that they can't do in their classrooms because they haven't the proper equipment or connection levels. Emerging technological developments should be touched on in staff development workshops, but the program will be most successful when it focuses on making the most of the telecommunications technology currently available to participants. Similarly, presenters should introduce examples and skills that are appropriate for the teaching levels, content specialties, and experience of the participants.

5. Use Genuine Teaching Examples. Hypothetical examples abound for using online resources to enhance the curriculum. However, participants will get more from programs that show how real teachers have used telecommunications for specific educational purposes, perhaps including examples of student work. Drawing on any local "pioneers" in this area can be particularly motivating.

6. Provide Supporting Materials. Every staff development experience needs to include take-away materials that help teachers apply what they have learned when they go it alone back in the classroom. These can include background articles, step-by-step instructions for doing the online activities demonstrated, and copies of presentation slides or outlines that make note-taking easier.

■ *Odvard Egil Dyrli, a columnist and contributing editor for* Technology & Learning, *is Professor Emeritus of Education at The University of Connecticut, and an educational technology consultant nationwide (dyrli@uconnvm.uconn.edu).*

Getting Focused for Sound Technology Leadership

II. Getting Focused for Sound Technology Leadership

The following information and activities engage school leaders in a process for focusing their energies constructively and productively for meaningful technology leadership. This section of the workshop includes four components:

A. Clarify Your Philosophical Base

This component offers an opportunity to clarify your beliefs and the beliefs of your district regarding technology and education in the Communications Age. This activity contributes to an accurate assessment of the current status.

B. Maximize Your Knowledge and Experience Base

This section assists participants in realizing and identifying the value of their knowledge and experience for addressing challenges associated with technology. This information contributes additional valuable information about current status.

C. Describe the Vision You Possess for Your District

Having addressed aspects of current status in the first two activities, this component engages participants in a visioning exercise that helps build and clarify direction for technology-related efforts in the next 3-5 years.

D. Assess Gaps, Resources, and Constraints

Based on the information about current status and a vision for the district, the workshop participants note specific gaps as well as resources and constraints for addressing the gaps. Participants review gaps, resources, and constraints as these items relate to the areas of system and resources, technical infrastructure, people infrastructure, and technology-infused teaching and learning.

Completing the four components of this section positions workshop participants to consider specific strategies for addressing technology leadership issues. Section III. of the workshop offers a collection of strategies for getting started.

A. Clarify Your Philosophical Base

Given the suggested factors, complete the matrix addressing your own beliefs and your perception of your district's beliefs regarding technology and education in the Communications Age. Your responses may include your perceptions of issues and implications associated with the "changing times." As you engage in the following activity, focus on direct, simple answers to the questions *"What do I believe?"* and *"What does my district believe?"* Clarifying your philosophical base contributes to an accurate snapshot of your current status regarding educational technology leadership efforts.

Belief/Implications "Starters"	Your Beliefs	Your District's Beliefs
• School is more than a place; school is everywhere. • Basic literacy is more than the three R's. • Lifelong learning is essential for all citizens. • Changing sociological structures and practices impact education. • Technological convergence is accelerating.		

1) Write a headline that captures and reflects "your beliefs."

2) And, write a headline that captures and reflects "your district's beliefs."

B. Maximize your Knowledge and Experience Base

Despite the inherent expectations and imposition of rapidly advancing technologies on educational leaders, every leader possesses valuable knowledge and experiences. It is important to view that knowledge and experience in relation to our philosophy about schools in the Communications Age. If an educational leader objectively reviewed his/her resume in light of the challenges of rapidly advancing technology and school change, which resume items reflect "valued" knowledge and experience for addressing school reform. In particular, an educational leader needs a realistic, meaningful view of himself/herself. Potentially, that objective view empowers an educational leader for effectively leading educational initiatives and pursuing appropriate, productive professional development experiences. Likewise, an educational leader should honestly reflect on his/her district's base of knowledge and experience. Using the suggested variables as a starting point, complete the matrix regarding yourself and your district.

As you pursue this activity, focus on answering questions such as ***"What do I bring that can contribute to technology initiatives?"*** or ***"What foundation does my district possess for pursuing technology initiatives?"***. Hopefully, answers to these questions contribute to a meaningful picture of current status. Establishing current status is essential for targeting energies toward progress as productively as possible.

Knowledge/Experience "Starters"	Your Base of Knowledge & Experience	Your District's Base of Knowledge & Experience
• Personal/professional attributes.		
• Opportunities pursued.		
• Obstacles overcome.		
• Lessons learned.		
• Lifelong learning practices.		
• Communication/organization skills.		
• Diversity and depth of employment experiences.		
• Technology engagement.		
• School change accomplishments.		

1) Write a 25-word resume that captures and reflects "your base of knowledge and experience."

2) And, write a 25-word resume that captures and reflects "your district's base of knowledge and experience."

3) If I could relive the last decade and enhance my "base of knowledge and experience" in one way, I would:

4) And, if I could replay the last decade in my district and enhance my district's "base" in one way, I would:

C. Describe the Vision You Possess for Your District

Facilitating meaningful technology leadership requires a valid perspective of "where one is" as well as a vision of "where one is headed." This activity is designed to encourage leaders to think through their visions for their respective districts regarding technology-related, school change initiatives. In the next few minutes, think about and jot down a paragraph or two on the next page that succinctly describes your vision for your district in the next 3-5 years. Visualize yourself in a hot air balloon hovering over the buildings in your district. The roof is transparent so you have the privilege of viewing the interactions and activities throughout the facilities. Think about questions such as: ***"What do you observe?, Who do you see?, What are they doing?, How might you characterize the interactions?, Are roles of stakeholders shifting?, What are the teaching and learning activities?, and What tools are being used?"***

At this point in the process, you're asked to align or reconcile potential differences between your personal "current status" with your perception of your district's "current status" regarding Communications Age education. That is, as you think through the vision, integrate your personal "view" with the district's "view" in a manner that encourages cooperation and collaboration toward a shared vision. Some flexibility on your part, even though it means compromising the extent of the vision, may be vital to moving the district forward constructively and productively. Leaders need to strike the balance for a progressive, shared vision that encompasses strong support and heightens the probability for reaching the vision successfully.

As you engage in this activity, consider the grid of the four major areas associated with a sound, broad-based educational technology initiative. As mentioned earlier in these materials, those areas include: a) systems and resources, b) technical infrastructure, c) people infrastructure, and d) technology-infused teaching and learning.

Alternative Activity:
(If your district already has a current, descriptive vision, you might choose to use this opportunity to review and reflect on that vision. What aspects of that vision are most challenging for you as a school leader? How might the vision be shifted to address those aspects? What can you do personally to better align your energies and efforts with the vision?)

Vision "Starters"

- Students, teachers, administrators, and community members are engaged in lifelong learning activities.
- Students are functioning as learners and teachers. Teachers and administrators are functioning as learners as well as teachers.
- Project-based teaching and learning encompasses most of the school day.
- Rooms are arranged in creative configurations that facilitate cooperative work.
- School calendar has shifted to year-round school and many students attend 3-4 days each week.
- Each teacher and administrator has a professional development plan that specifies his/her "on the job learning."
- Every student has a personal computer for day-to-day learning activities.
- Teachers integrate text-based materials with a diversity of multimedia-based tools and products.

Your Vision for Your District

1) Write a headline that captures your vision for your district.

D. Assess Gaps, Resources, and Constraints

As educational leaders work toward a shared vision and a healthy perspective of their current status, it is important to note gaps between the vision and status. Also, it is important to identify resources and constraints that can impact the gaps positively or adversely. Starting with the suggested factors, complete the matrix summarizing key gaps, resources, and constraints. As you pursue this activity, focus on answering such questions as ***"What are the gaps between the vision and current status?, What resources are needed or available for addressing the gaps?, What constraints need to be addressed in pursuing the gaps?, and What is my role in pursuing gaps, resources, and constraints?"***. Once again, as you engage in this activity, consider the grid of the four major areas associated with a sound, broad-based educational technology initiative. As mentioned earlier in these materials, those areas include: a) systems and resources, b) technical infrastructure, c) people infrastructure, and d) technology-infused teaching and learning.

Gap/Resource/Constraint "Starters"	**Your View of and Role in Gaps, Resources, and Constraints for Pursuing Your District's Vision**
• Leadership	
• District organization and structures.	
• Fiscal-related resources.	
• Technical infrastructure.	
• People infrastructure.	
• Learning environments.	
• Teaching and learning practices.	

1) Identify the two most significant gaps between the vision and current status for your district.

2) In pursuance of technology-related initiatives, identify one significant "resource" and "constraint" for your district.

3) Write a headline that captures/describes your primary role in pursuance of technology-related initiatives in your district.

Pursuing Strategies and Tools for Enhancing Technology Leadership

A. Communication for Relating to Audience

Primary Question Addressed by Strategy:

• Am I communicating educational technology-related issues meaningfully and effectively?

Sources, Context, and Support Materials for Strategy:

•Relating the Realities of Technology and Changing Schools to Communities

A couple of years ago, respected technologist Jim Mecklenburger wrote: "The world is really changing, but finding the words to characterize the meanings of these changes in attractive ways is still a quest." As technology leaders across the country guide their schools and communities through the challenges posed by rapidly advancing technologies, they gain firsthand, and often painful, experience about the truth of Mecklenburger's statement. Every community and culture includes a broad range of philosophies and attitudes about "our changing world." Some are progressive and eager to embrace the opportunities that change offers. Others are adversarial and resistant to the unknown implications associated with change processes. Most others fall somewhere in between the eager and resistant--complacent or uncertain about all the strong reactions to changes associated with the Communications Age.

The bottom line for technology leaders is acknowledging and respecting the opinions of colleagues and community members, and then initiating strategies that can raise awareness and build support for valid technology and related change efforts. Moving that agenda forward requires thoughtful consideration of the targeted audience. Rather than a confrontive approach, it may be more successful to work at reviewing controversial issues through the lenses of resistant colleagues or community members. As technology leaders, consider initiating dialogue with reluctant colleagues and community members and clarify your perceptions of their opinions and understanding. With a clearer perception in mind, invest your energies in developing "tools" that can assist in communicating your thinking and intent to the community in practical ways that they can relate to meaningfully.

On the following pages are examples that have served me well in working with adversarial persons regarding the implications of technology and school change. The first example, Understanding Current Reality is Critical, is built around principles that were driving General Motors production in 1973. Nearly everyone relates to the reality, but absurdity, of the principles as we look back at them through the lenses of more than two decades of history. Using that framework, I developed a version of Understanding Current Reality is Critical that reflects some

observations/implications about the current state of education. The educational version stimulated a host of constructive and productive discussion within a context that community members could relate to more easily and comfortably.

The second example stems from an experience with a state legislative body. A legislative committee was considering the implications of educational technology for schools in response to a charge from the Governor to identify potential legislation for facilitating cost-saving measures for schools. As part of its study, the legislative committee was reviewing the potential of technology as a tool to save money in school operation. The mean age of the committee members approached retirement, and in general, they were leery of the potential purported for rapidly, advancing technologies. Recognizing that the state operated on a strong agricultural base, I developed a tool entitled The Agricultural Version of Technology in Schools to relate some of the tools and variables of farming to educational technology. The comparison generated a very rich discussion that impacted the view and reaction of many committee members.

Based on the examples, educational technology leaders are encouraged to think through current challenges and barriers they face as they guide and encourage their respective communities to pursue technology opportunities. Then, consider designing a "tool" that presents "the words to characterize the meanings of those changes in attractive ways." Using this strategy communicates to your target audience that your willing to invest energy in understanding their perspective and that you wish for them to relate to the issues of change in meaningful ways.

James D. Parry, Ph.D.

Understanding Current Reality Is Critical

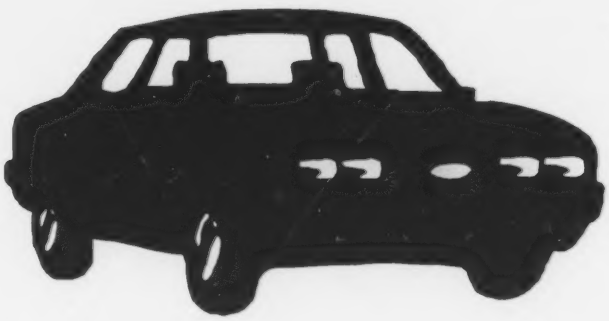
General Motors is in the business of making money, not cars.

Cars are primarily status symbols. Styling is more important than quality because customers are going to trade up every 27 months.

The U.S. car market is isolated from the rest of the world. Therefore, foreign competition will never gain more than 15% of the domestic market.

Energy will always be cheap and abundant.

Workers do not have an important impact on production or quality control.



Understanding Current Reality is Critical

Schools are in the business of teaching the three R's, not preparing students for productivity in the Communications Age.

Education is primarily about 12 years seated at a desk. Being in class from 8 till 3 about 175 days a year is more important than students demonstrating competencies that respond to the realities of a global society and economy.

The U.S. education system does not need to be concerned that students in foreign countries are "better" educated than American students. Foreign-educated students will never gain more than 15% of the jobs in America.

Or, the U.S. public education system does not need to be concerned about the increasing number of students in private and home schools. This competition with the public schools will never gain more than 15% of the total number of students.

As long as we have children, **there will always be public schools with classrooms, rows of desks, teachers, and textbooks.**

Even though teachers have a major impact on students, **directing significant resources toward staff development is irresponsible** in light of shrinking resources for school budgets.

James D. Parry

The Agricultural Version of Technology for Schools

Tractors

Tillers
Planters
Cultivators
Sprayers
Combines

Seed
Fertilizer
Chemicals

Harvest of Grain

Rain
Sunshine

Computers

CD-ROM/Disk Drives
Printers
Scanners
Cameras
Projectors

Students and Educators
CD-ROMs, Software,
Telecommunications Access
Training

Students with relevant Communications Age experiences

School/Community Structure,
Priorities, and Values

James D. Parry, PhD

B. Graphic Organizers for Systems Thinking

Primary Question Addressed by Strategy:

• Am I approaching educational technology issues with a sound "systems thinking" perspective?

Sources, Context, and Support Materials for Strategy:

• Systems Thinking Article

Technology leaders are challenged to view technology applications and issues within the context of the whole system. For too long, educators focused on technology as primarily an infusion of hardware. As leaders have gained knowledge and experience, they've discovered the necessity of placing technology appropriately within the context of entire school system and beyond. The following article by Costa and Kallick offers a practical strategy to assist leaders in examining processes and interactions surrounding dynamic issues such as educational technology. The authors propose the development of graphic organizers to encourage systems thinking that facilitates attention to whole systems as well as the relationships among the parts.

Systems Thinking: Interactive Assessment in Holonomous Organizations

ARTHUR L. COSTA AND BENA KALLICK

> "The learning organization is 'a place where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning how to learn together.'"
>
> —PETER SENGE

As quoted above, Senge describes a learning organization with words and images such as create, new, expand, and nurture. His metaphors are quite different from those we currently use in schools, where teachers talk about "battling" the system for needed resources and administrators describe teachers as "in the trenches." A classroom is the "first line of defense," and students talk about "bombing out on a test." A school system's response to problems is "strategic planning" with new "tactics," an approach that implies a command/demand relationship.

All in all, such images suggest combative relationships among various parts of a system that is permeated by top-down authoritarianism and fragmentation. The farther away you are from students, the greater the inconsistency in principles and practices. Each part of the organization has little to do with other parts; each department works in isolation.

Instead of such a battlefield, imagine a garden where the interdependent balance of the system allows each plant to flourish. The gardener plants a seed in fertile soil, nurtures the seedling and its environment, and harvests with an eye to the future of the garden as well as to his or her immediate needs. The gardener cares for the whole to ensure the growth of each part. Such is the atmosphere of a true learning organization, where the paradigm of systems thinking encourages growth for all participants.

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FROM: ASSESSMENT IN THE LEARNING ORGANIZATION: SHIFTING THE PARADIGM (ASCD, 1996)

SYSTEMS THINKING

Systems thinking requires constant attention to the whole along with an analysis of whether its parts are, indeed, interdependent and interconnected. In his work on systems thinking, Senge conceives of an intentional connection and relationship among these parts and the organization as a whole. Members of systems need to learn how to map this whole and follow the connections. In classrooms, this is often referred to as interdisciplinary thinking; in organizations, we call it systems thinking.

Systems thinking fulfills a need to comprehend the boundaries, rules, and understandings within a part of the total system and, at the same time, to discern its interconnections. Although we often think of boundaries as ways of defining turf, systems thinking highlights the relationships among bounded groups. Data provide the energy source for continuous learning. Data are produced at the boundary of interaction between the unit and the larger environment. For example, Figure I.1 is a graphic organizer depicting one way a system functions. Circles delineate the boundaries of various groups, and lines connecting these circles demonstrate their interdependence.

Such systems maps serve as tools for understanding when we want to examine processes and interactions such as:

- how decisions are made,
- how disciplines work together,
- how new practices are initiated,
- how financial resources are spent,
- how time is managed, and
- how priorities are established.

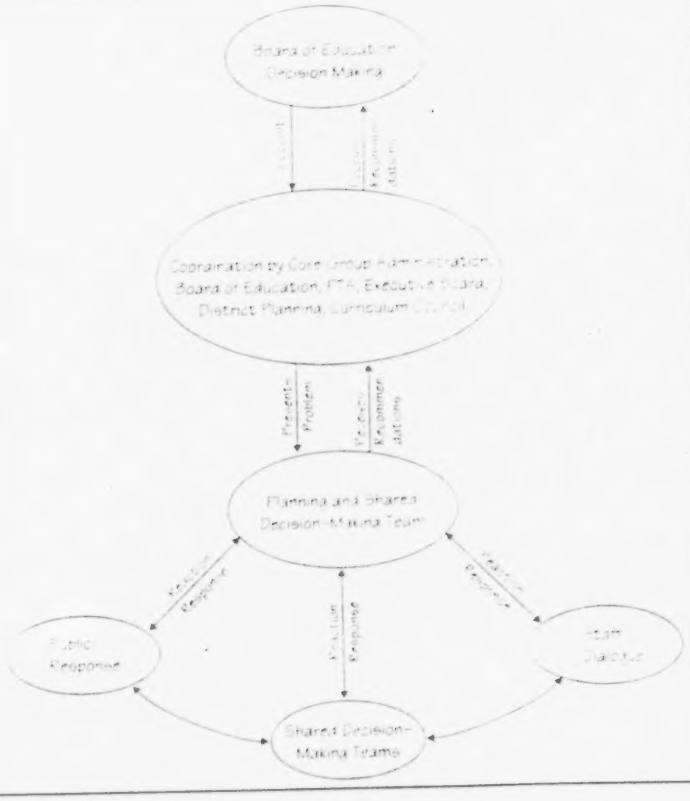
For example, one district's overworked and exhausted administrative group faced the question: "How do we manage to get so many things on our plate every year?" They decided to map one innovation to understand how everything accumulated.

When they came together to address the question, each administrator individually mapped how he or she thought a particular decision was made: Who initiated the innovation? How was it discussed? Where did the discussions lead? Who finally made a decision? What were the consequences of the decision? Was there an anticipated sequel to the decision?

The maps were posted on the wall, and, interestingly, they showed a great discrepancy. The administrators studied each map and talked about the different perceptions. As a result of their analysis, they identified problems in the decision-making process as it was perceived and as it actually took place. This kind of analysis is an

FIGURE I.1

Graphic Organizer of System Functions



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extremely valuable assessment tool when creating an environment for change.

We like to think of systems thinking in four ways:

- All the players are at once beneficiaries and leaders of the system.
- All players in the system see the parts-whole relationship, and they view their particular operation as part of a larger whole.
- Altered or innovative thinking in one part of the system affects the total system. If a creative idea or new approach is employed in one part of a system, it affects all other parts of the system.
- Everyone in the entire system is perceived to be a continual learner as well as a caring, thinking individual capable of complex decision making, creativity, problem solving, and continued intellectual development.

When adopting a new paradigm, all aspects of the system must change in accordance with the new perspective. Paradigm shifting, therefore, does not become fully operable until all the parts of the system are changed and aligned with the new paradigm. Any system is a synergistic relationship of interlocking parts; as one part changes, it affects the others. No one part can operate efficiently unless the other parts of the system work in harmony.

Wheatley observes that "organizations are conscious entities, possessing many of the properties of living systems." Therefore, every aspect of a learning organization—individuals, classrooms, schools, the district, and the community—needs to be dedicated to continual analysis, assessment, and reflection on system practices. The Japanese call this constant state of growth and self-renewal *kaizen*.

HOLONOMY: INTERACTIVE ASSESSMENTS IN THE LEARNING ORGANIZATION

Arthur Koestler (1972) refers to the parts-whole interaction as holonomy. The term "holon" comes from the Greek "holos," which means the whole, and the suffix "on," which means part. The holonomous organization, therefore, consists of two components: parts and whole. One function of the holonomous organization is to support people in becoming autonomous and self-actualizing. This implies that each unit in the organization—individuals, classrooms, schools, districts, and the state—will become self-evaluating, self-renewing, and self-modifying.

Yet the concept of holonomy transcends individual autonomy and supplies a missing link between the individual and the larger organization. It supplants the dualistic thinking about parts and wholes that is so deeply ingrained in our mental habits and hierarchical metaphors. Autonomous individuals can be characterized as self-regulating, open systems governed by fixed rules that account for their coherence, stability, and specific pattern of structure and function. However, autonomous units cannot exist alone; they are always interacting with a larger unit or smaller units within. The concept of holonomy reconciles this parts-whole polarity and transcends the notion of an autonomous organism functioning only as a sub-part of a larger organization, which in turn is but a part of a still larger universe.

Koestler emphasizes that every individual part has the dual tendency to preserve and assert its individuality as a proud and quasi-autonomous whole, even while functioning as a humble part of a larger whole. This polarity between the self-assertive and integrative tendencies of organisms is inherent in the concept of hierarchic order and is a universal characteristic of life.

Consider the human heart, for example. It performs a unique function with its own intrinsic rhythm and pattern of functioning. The heart will assert this characteristic pattern of activity even when transplanted to another body. On the other hand, the heart's activities are initiated, inhibited, or modified by the autonomic nervous system, hormones, and other influences inside and outside the human body. Thus, the self-assertive tendency of the autonomous heart has its counterpart in its integrative function as a part of a larger system.

Likewise, in an educational community, each teacher may be thought of as a proud, autonomous individual: self-asserting, self-perpetuating, and self-modifying. However, the autonomous teacher is also

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part of a larger whole and is influenced by the attitudes, values, and behaviors of the school culture. In turn, the school is an autonomous unit, but it is organized around its own unique community, vision, and goals while maintaining an interactive relationship with the larger district and community (Costa and Garmston 1994).

FRACTALS: PARALLEL ASSESSMENTS IN THE LEARNING ORGANIZATION

> The very best organizations have a fractal quality to them. An observer of such an organization can tell what the organization's values and ways of doing business are by watching anyone, whether it be a production floor employee or a senior manager. There is consistency and predictability to the quality of behavior. No matter where we look in these organizations, self-similarity is found in its people, in spite of the complex range of roles and levels.
>
> MARGARET WHEATLEY

Many natural systems possess a fractal quality; that is, they share similar details on many different scales and levels (Briggs 1992). Consider the endless duplication of the patterns of a cauliflower or the repetitions in the shape of a fern. Focusing on any part of these systems reveals a reproduction of the larger system itself. Similarly, any one part of an organization will provide a lens into the whole organization.

We believe that assessment is a potent force in achieving an holonomous organization (one that is interdependent) and gives it a fractal quality (where examination of any one aspect offers insight about all aspects) by:

- providing data about the degree to which various parts of the school community interact in productive and interdependent ways;
- providing data about processes as well as behaviors that affect the school community;
- providing data about the degree to which processes in the school are evident and parallel regardless of position in the hierarchy; we expect the same set of behaviors and values to be observed in the meetings of the board of education and faculty meetings.
- gathering, analyzing, reflecting upon, and acting on the data in a thoughtful way (see Feedback Spirals in Part II).

Only as these attributes become consistent throughout an entire system—self, classroom, school, district, and eventually the community—will it become an holonomous learning organization. So, for example, a system may consider a new form of assessment in several ways (Figure I.2):

FIGURE I.2
Interactive Assessment of Holonomous Units

- At the student level: "What constitutes evidence of outcomes achieved at the student level?"
- At the level of classroom teachers: "What might a teacher's portfolio contain?"
- At the school level: "What artifacts would go in a school's portfolio to show evidence of growth and change as a learning organization?"

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- At the central office level: "How might administrators use portfolio assessment to demonstrate their growth?"
- At the superintendent's level: "How might the use of portfolios demonstrate accomplishments to the Board of Trustees?"
- In hiring practices and policies: "Do incoming candidates being considered for employment present their portfolios upon application?"

Because the concept of holonomy is interactive, no assessment of any one unit is complete without assessing the surrounding units. To assess student progress toward desired outcomes—cooperative learning, for example—the presence of that quality in classroom conditions must be monitored as well. To assess teacher performance, the quality of cooperation and collaboration in the school workplace must be examined. And to assess the quality of cooperation in the school district, community support and commitment toward collaboration and cooperation must also be assessed. Thus, a well-conceived assessment design includes a search for consistency, congruence, and integrity in the surrounding conditions and climate that directly influence each unit in the holonomous organization.

> The word *dharmic* is Sanskrit for deep, deep integrity—living by your inner truth. *Dharmic Management* means bringing that truth with you when you go to work every day. It's the fusing of spirit, character, human values, and decency in the workplace and in life as a whole.
>
> —Jack Hawley

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From Paradigm to Practice I: Systems Thinking

Interactive Assessment in Holonomous Organizations

No single unit of an organization can function autonomously; rather, it is part of a larger universe and is composed of smaller units itself. Therefore, no single unit of an organization can be assessed without also assessing the larger universe of which it is a part. Coupled with Part II on Feedback Spirals, we now present three articles by administrators who constantly search their environment for indicators that their goals are being achieved: Diane Zimmerman, at an elementary school; William Sommers, at the secondary level; and Michael Couchman, at the district/community level. Each example illuminates the significance of developing a recursive process to continuously monitor the integrity of an organization by examining the alignment of purposes and outcomes with daily practice and the organization's culture.

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C. Rules for Decision Making

Primary Question Addressed by Strategy:

• How am I making or facilitating sound decisions surrounding education technology-related issues?

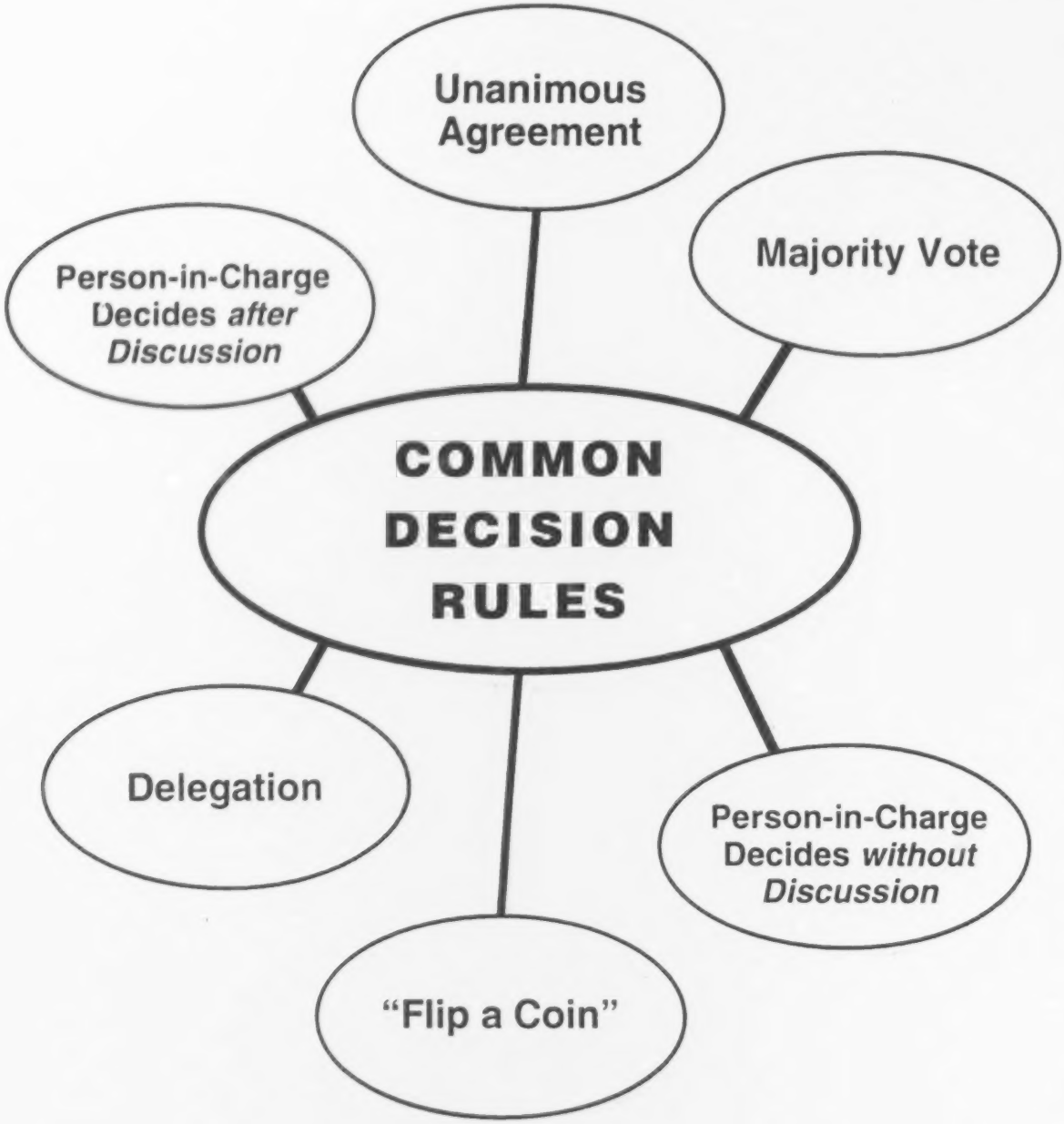
Sources, Context, and Support Materials for Strategy:

• Common Decision Rules Guide

Decision-making is a challenge for leaders. Within traditional hierarchical organizational structures, most, if not all, decisions are made by a central figure. As organizational structures are shifting to be more collaborative in nature, the process of decision-making has become more participatory and complex. Even those school leaders who embrace more collaborative organizational structures often face significant pressure regarding technology decision-making.

If educational leaders possess a knowledge of the subject that requires decision-making, they generally feel comfortable with decision-making processes that engage other parties and differing views. For the most part, they're open to sharing the decision-making process because they sense a personal confidence for assessing and responding effectively to a diversity of input. But when the decision-making shifts to a subject such as rapidly advancing educational technology for which educational leaders may have limited knowledge and experience, they feel more vulnerable and uncertain about collaborative decision-making efforts. Thus, educational leaders are encouraged to make a concerted effort to clarify decision-making that surrounds educational technology issues.

The attached section from the *Facilitator's Guide to Participatory Decision-Making* provides basic information and suggestions for structuring decision-making. The information offers specific strategies for thoughtfully structuring meaningful decision-making.



A decision rule is a mechanism that answers the question, "How do we know when we've made a decision?" Each of the six rules shown above performs this basic function.

Individual members act on their own idiosynchratic perspectives. Soon, the left hand doesn't know what the right hand is doing.

Those who whine or raise their voice get what they want.

Someone says, "Let's put this on next month's agenda and pick up where we left off." But at the next meeting, the item is superseded by urgent new business.

Some people hold onto rigid, fixed positions and stalemate the discussion.

"DECISION-MAKING" WITHOUT A DECISION RULE

Just as time runs out, someone makes a new suggestion. This becomes "the decision."

Someone's name gets vaguely attached to a poorly defined task (as in, "Duane, why don't you check into that?") Later, that person gets blamed for poor follow-through.

After the meeting ends without agreement, a few people meet behind closed doors and make the real decisions.

The person who has the most at stake makes an independent decision; later, people resent him/her for taking actions that did not meet other people's needs.

Certain people *always* get their way.

When a quick decision has to be made or an opportunity will be lost, conservative members exercise a pocket veto by stalling the discussion. Thus, "no decision" becomes a decision not to act.

The person-in-charge says, "Is everyone okay with this idea?" After a few seconds of silence, the person-in-charge moves to the next topic, believing that every member's silence meant "yes," rather than "no" or "I'm still thinking."

The meeting goes overtime; the discussion drags on and on . . .

MAJOR DECISION RULES: USES AND IMPLICATIONS

» UNANIMOUS AGREEMENT

High-Stakes Decisions

In groups that decide by *unanimous agreement,* members must keep working to understand one another's perspectives until they integrate those perspectives into a shared framework of understanding. Once people are sufficiently familiar with each other's views, they become capable of advancing innovative proposals that are acceptable to everyone. It takes a lot of effort, but this is precisely why the unanimous agreement decision rule has the best chance of producing sustainable agreements when the stakes are high.

The difficulty with using unanimous agreement as the decision rule is that most people don't know how to search for Both/And solutions. Instead, people pressure each other to live with decisions that they don't truly support. And the group often ends up with a watered-down compromise.

This problem is a function of the general tendency of groups to push for a fast decision: "We need unanimous agreement because we want everyone's buy-in, but we also want to reach a decision as quickly as possible." This mentality undermines the whole point of using unanimous agreement. Its purpose is to utilize the tension of diversity for creative purposes – to invent brand new ideas that really do work for everyone. This takes time. In order to realize the potentials of unanimous agreement, members should be encouraged to keep working toward mutual understanding until they develop a proposal that will receive enthusiastic support from a broad base of participants.

Low-Stakes Decisions

With low-stakes issues, unanimous agreements are usually comparable in quality to decisions reached by other decision rules. Participants learn to go along with proposals they can tolerate, rather than hold out for an innovative solution that would take a lot of time and effort to develop.

One benefit of using the unanimous agreement rule to make low-stakes decisions is that it prevents a group from making a decision that is abhorrent to a small minority. Other decision rules can lead to outcomes that are intolerable to one or two members, but are adopted because they are popular with a majority. By definition, such a decision will not be made by unanimous agreement.

MAJOR DECISION RULES: USES AND IMPLICATIONS

» MAJORITY VOTE

High-Stakes Decisions

Majority vote produces a win/lose solution through an adversarial process. The traditional justification for using this rule when stakes are high is that the competition of ideas creates pressure. Thus, the quality of everyone's reasoning theoretically gets better and better as the debate ensues.

The problem with this reasoning is that people don't always vote based on the logic of the arguments. People often "horse trade" their votes. Or they vote against opponents for political reasons. To overcome this problem, group members should be exhorted to vote on the merits of the idea. For high-stakes issues, secret ballots help preserve the integrity of the vote.

Low-Stakes Decisions

When expedience is more important than quality, majority vote strikes a useful balance between the lengthy discussion characteristic of unanimous agreement, and the lack of deliberation that is a danger of the other extreme. Group members can be encouraged to call for a quick round of pros and cons, and then to get on with the vote.

» FLIP A COIN

High-Stakes Decisions

Flip a coin refers to any arbitrary, random method of making a decision, including common practices like drawing straws, picking numbers from a hat or "eeny-meeny-miney-moe." Rare is the group that would consider using a coin flip to make a high-stakes decision.

Low-Stakes Decisions

Knowing the decision will be made arbitrarily, most members stop participating – their comments won't have any impact on the actual result. However, this is not necessarily bad. For example, how much discussion is needed to decide whether lunch should be forty-five minutes or one hour?

MAJOR DECISION RULES: USES AND IMPLICATIONS

» PERSON-IN-CHARGE DECIDES *AFTER DISCUSSION*

High-Stakes Decisions

There is strong justification for using this decision rule when the stakes are high. The person-in-charge, after all, is the one with the access, resources, authority and credibility to act on the decision. Seeking counsel from group members, rather than deciding without discussion, allows the person-in-charge to expand his/her understanding of the issues, and form a wiser opinion about the best course of action.

Unfortunately, some group members give false advice and say what they think their boss wants to hear, rather than express their true opinions. *

To overcome this problem, group members can design a formal procedure to ensure/include "devil's advocate" thinking, thus allowing people to debate the merits of an idea without the pressure of worrying whether they're blocking the group's momentum. Or, group members can schedule a formal discussion without the person-in-charge. They can then bring their best thinking back to a meeting with him/her to discuss it further.

Low-Stakes Decisions

There are three decision rules that encourage group discussion: unanimous agreement, majority rule, and person-in-charge decides after discussion. With low-stakes issues, all three decision rules produce results that are roughly equivalent in quality.

When the stakes are low, the person-in-charge is less likely to feel pressured to "get it right," and is therefore less defensive, and more open-minded. Similarly, group members are less afraid of being punished for taking risks. Accordingly, low-stakes issues provide a group with the opportunity to practice honest, direct advice to the person-in-charge.

* Irving Janus, in his ground-breaking classic on the group dynamics of conformity, *Victims of GroupThink* (Boston: Houghton Mifflin, 1972) describes many case studies demonstrating this problem. For more suggestions on ways to overcome this problem, see pages 207-224.

MAJOR DECISION RULES: USES AND IMPLICATIONS

» PERSON-IN-CHARGE DECIDES *WITHOUT DISCUSSION*

High-Stakes Decisions

When a person-in-charge makes a decision without discussion, s/he assumes full responsibility for analyzing the situation and coming up with a course of action. Proponents argue that this decision rule firmly clarifies the link between authority, responsibility and accountability. Detractors argue that this decision rule creates a high potential for blind spots and irrationality.

The most appropriate time for a person-in-charge to make high-stakes decisions without discussion is in the midst of a crisis, when the absence of a clear decision would be catastrophic. In general, though, the higher the stakes, the more risky it is for anyone to make decisions without group discussion.

How will group members behave in the face of this decision rule? The answer depends on one's values. Some people believe that good team players are loyal, disciplined subordinates who have the duty to play their roles and carry out orders. Other people argue that group members who must contend with this decision rule should develop a formal mechanism, like a union, for making sure their points of view are taken into account.

The fundamental point is that whenever one person is solely responsible for analyzing a problem and solving it, the decision-maker may lack essential information. Or those responsible for implementation might sabotage the decision because they disagree with it or because they don't understand it. The more the person-in-charge understands the dangers of deciding without group discussion, the more capable s/he is of evaluating in each situation whether the stakes are too high to take the risks.

Low-Stakes Decisions

Not all decisions made this way turn out badly. In fact, many turn out just fine. And when the stakes are low, even bad decisions can usually be undone, or compensated for.

Low-stakes decisions are often implemented by someone other than the person-in-charge. The person-in-charge may want to delegate decision-making authority to those most responsible for implementation.

REACHING CLOSURE

FLEXIBILITY vs CLARITY

DECISION RULES: A BASIC DILEMMA

Many work-groups have difficulty establishing a clear *decision rule.* This is especially common in groups that are run by a person-in-charge. Frequently, the problem is that the person-in-charge does not feel obligated to use a single decision rule. "Sometimes," said a division manager, "I want everyone in my group to agree to a plan before we act on it. At other times I don't want to waste time, so I make the decision myself."

From the point of view of the person-in-charge, it does not make sense to be tied down to a particular rule. But from the perspective of the group members, the inconsistency can be enormously confusing.

For example, a software publishing company held monthly meetings that were chaired by the chief operating officer and attended by all department managers. The managers complained that the meetings were very frustrating. "Sometimes the boss cuts off discussion after five minutes," they grumbled. "At other times he lets it run on and on. Sometimes it seems like he wants us to buy into a decision he's already made; other times he couldn't care less what we think; and then there are times when he wants us to figure out every little detail. It's driving us crazy!"

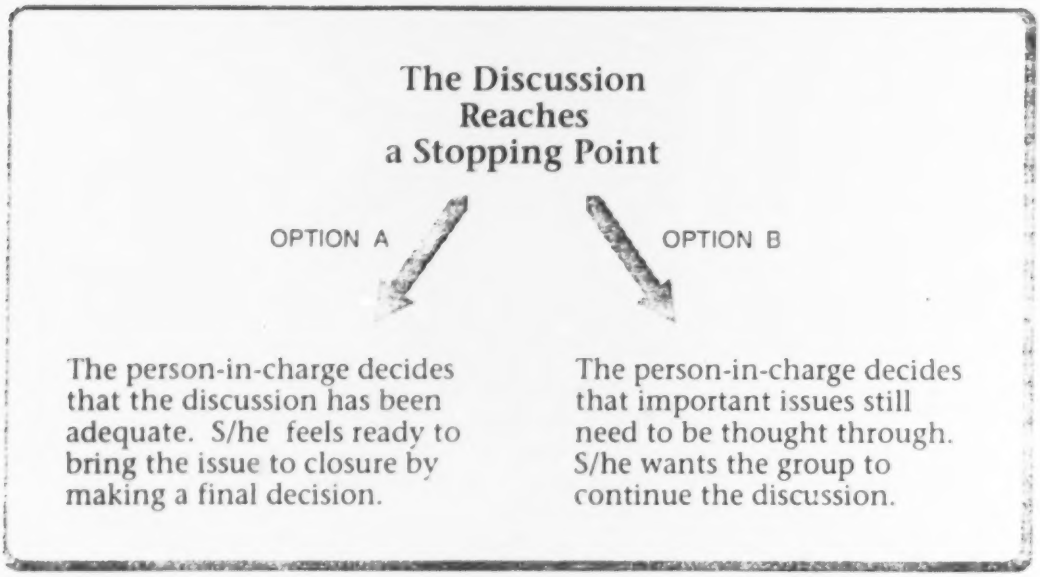
This is an intriguing example. From the perspective of the person-in-charge, his behavior was perfectly logical! He knew what the decision rule was – *person-in-charge makes the decision after group discussion.* But in each particular case he made a judgment call to determine how much discussion the issue warranted. At times – when the stakes were low or when a solution seemed obvious – he decided it was fine to make a quick decision with very little discussion. At other times, when he wanted everyone to take ownership of the outcome, he kept the discussion going in search of better ideas.

The problem was that he did not share this reasoning with the group. He made all his judgments in his head. The group members had no idea that there was a method to his madness. To explain his apparent inconsistency, they made up all kinds of stories: He was manipulating them. He was fearful of corporate politics. He was incompetent as a leader.

This group provides a classic illustration of the tension between flexibility and clarity. The person-in-charge felt that clarifying his decision rule would handcuff him. He needed the flexibility to allocate time wisely. But leaving the decision rule vague didn't work, either. It prevented the group members from knowing whether and when their manager valued their participation.

REACHING CLOSURE

THE META-DECISION


The Discussion
Reaches
a Stopping Point
OPTION A
OPTION B
The person-in-charge decides that the discussion has been adequate. S/he feels ready to bring the issue to closure by making a final decision.
The person-in-charge decides that important issues still need to be thought through. S/he wants the group to continue the discussion.

This diagram portrays a situation that comes up all the time in groups: at a certain point in practically every discussion, the person-in-charge has to decide whether or not to end the discussion and make a decision.

To most people who play the role of person-in-charge, this fact is intuitively obvious. They recognize the situation because they deal with it every day. But it is *not* so obvious to the other participants at a meeting. They often don't know *how* to interpret what's going on. As a result of such confusion, people can become frustrated, angry and passive – exactly as happened in the example on the previous page.

Fortunately, it is easy to reduce the disparity between the perspective of the person-in-charge and the perspective of the other members. *The solution is to show everyone what the person-in-charge is doing.* When the choice point is made explicit, the confusion is removed.

Deciding whether or not to make a decision is called *making a meta-decision.**

* The word *meta* is Greek and means "above" or "about."

REACHING CLOSURE

THREE META-DECISIONS

THE DOYLE AND STRAUS *FALLBACK*

One of the most well-known meta-decision procedures is the Doyle and Straus *fallback*. Here's how it works.

Whenever a new topic is introduced, the person-in-charge sets a time limit. During that period of time, the group will strive to reach a unanimous agreement. If time runs out, the person-in-charge makes the meta-decision: either s/he will now bring the discussion to closure and make a final decision, or s/he will set a new time limit and reopen the discussion.

CAROLINE ESTES' *VOTE TO VOTE*

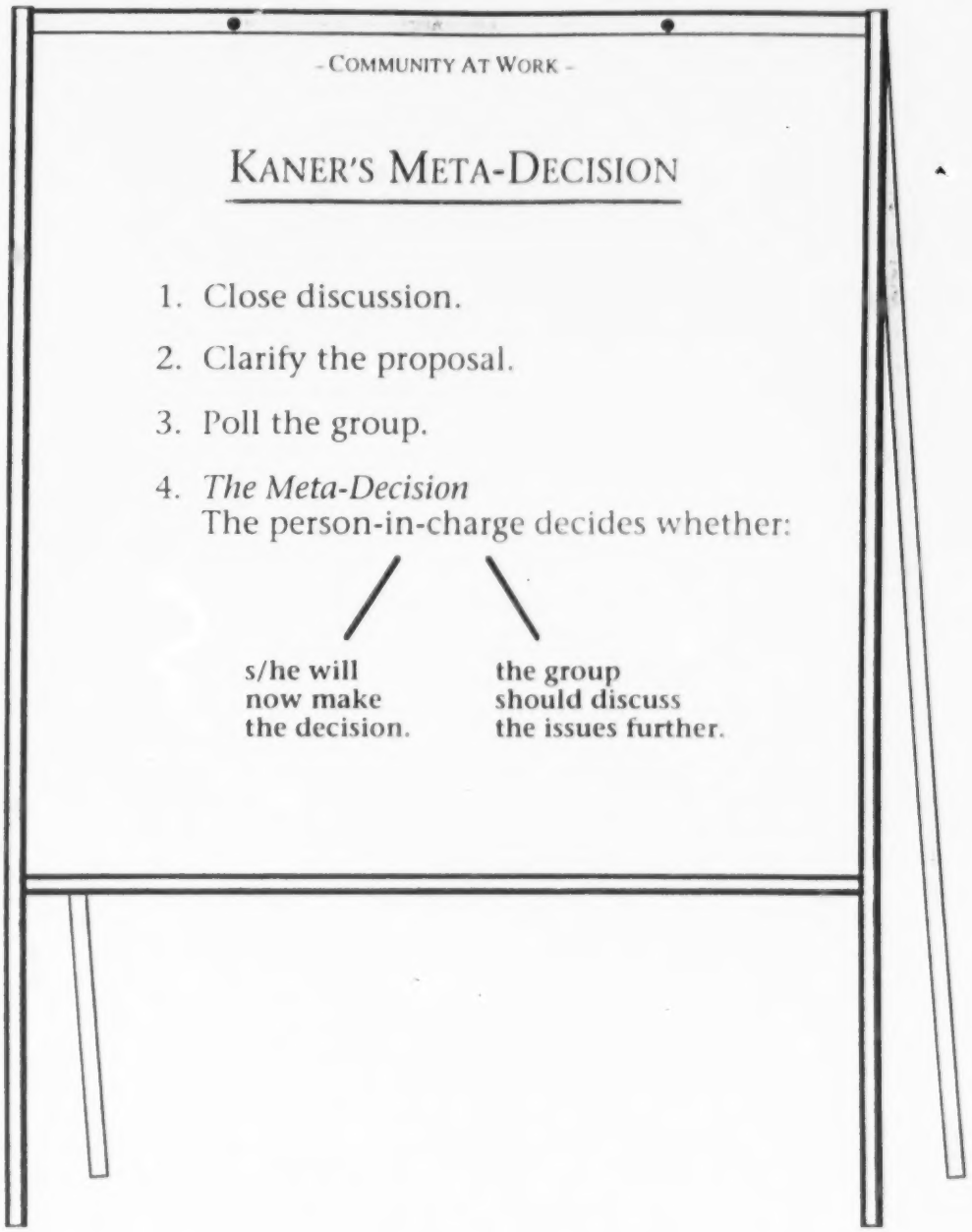
Meta-decisions also occur in groups that have no person-in-charge. For example, the U.S. Green Party, which uses unanimous agreement as its decision rule, has a meta-decision that allows it to switch from unanimity to majority vote. This meta-decision, called *vote to vote,* was popularized by Caroline Estes, one of the nation's leading experts in the field of large-group consensus decision-making.

The Greens have adapted this procedure: any group member can call for a vote to close discussion and switch from unanimity to majority. Immediately following this call, the vote is taken. If 80% of the voters favor switching, the discussion ends and the group uses majority rule to reach a decision on the proposal at hand; if fewer than 80% want to switch, the unanimity rule remains in effect and the discussion continues.

SAM KANER'S *META-DECISION*

This procedure is shown on the next page. Its central premise is that *polling helps a group obtain maximum benefit from the use of a meta-decision.*

In groups with a person-in-charge, it is highly advantageous for that person to use a *Gradients of Agreement scale* to take a poll before s/he makes a decision. If s/he sees adequate support from the group, s/he can make a decision with confidence that it will be implemented. However, if s/he sees that a proposal lacks sufficient support, s/he can reopen the discussion rather than make a decision that would be difficult to implement.


- COMMUNITY AT WORK -
KANER'S META-DECISION
1. Close discussion.
2. Clarify the proposal.
3. Poll the group.
4. The Meta-Decision
The person-in-charge decides whether:
s/he will now make the decision.
the group should discuss the issues further.

Kaner's meta-decision is designed to combine the benefits of participatory decision-making with the realities of hierarchical decision-making.

D. Relationships with Consultants and Partners

Primary Question Addressed by Strategy:

• Am I positioning technology-related expert resources and partnerships as powerfully as possible?

Sources, Context, and Support Materials for Strategy:

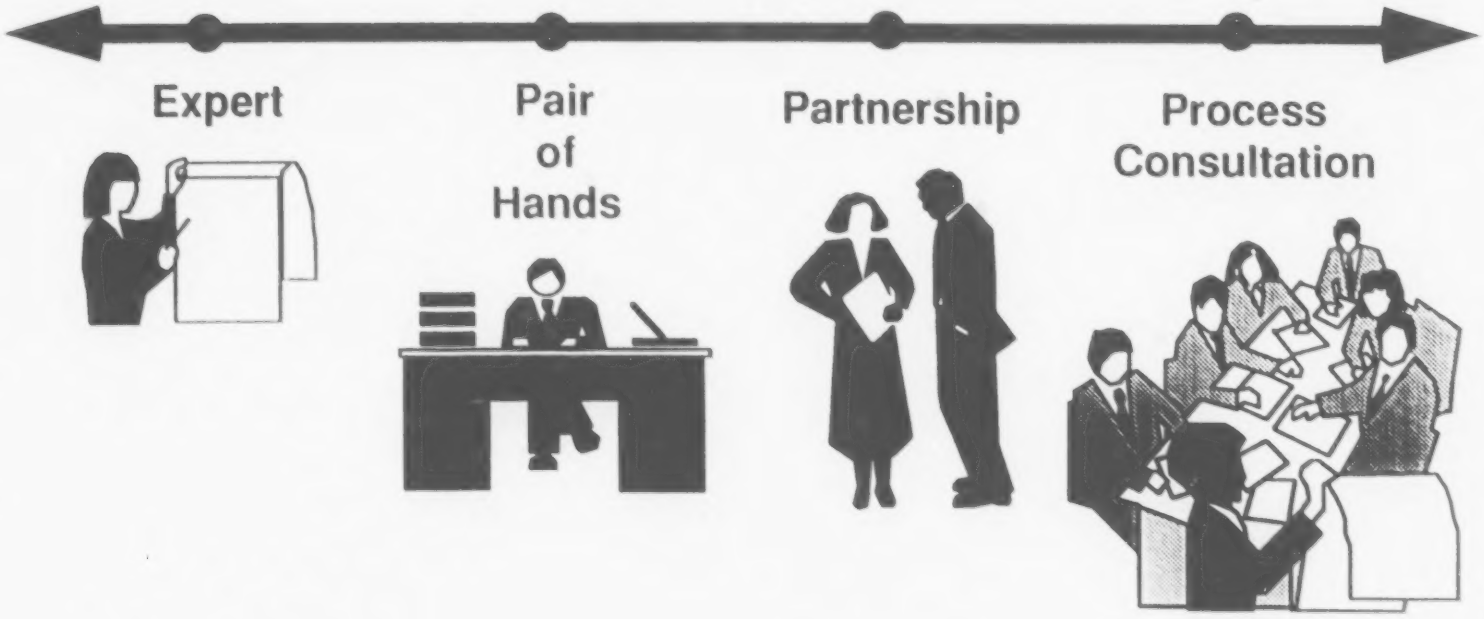
• Consultant and Partner Relationships and Roles

Despite the genuine efforts of technology leaders to keep abreast of rapidly advancing technologies, most indicate that they're holding a tiger by the tail. Sound technology planning, implementation, and integration depend on access to expertise and resources that can heighten the probability of productivity and success. Many schools employ technical personnel, technology coordinators, curriculum specialists, staff development facilitators, or others who can offer vital input to inform the organization's efforts to pursue technology meaningfully. But as technology evolves and the complexity of applications increases, more and more schools are engaging consultants and partners as resources for expertise and assistance.

The need for productive relationships with technology consultants and partners requires leaders to view consultative models in new terms. In particular, leaders need to establish relationships with consultants and clarify roles in a manner that maximizes the cooperative and collective energies of the district and the consultant. The following information suggests a continuum of consultant roles along with description of consultant activities that might characterize the interactions of the district and the consultant. (Descriptions are taken from Block's work entitled *Flawless Consulting: A Guide to Getting Your Expertise Used.*) In many cases, schools are engaging in activities with business partners. Certainly, the considerations regarding a district/consultant relationship have value for district/partner relationships. In fact, partners certainly function in many consultive roles by engaging in supportive and collaborative activities with schools.

As leaders consider the value of consultant/partner relationships, they are encouraged to focus on the benefits of a process consultation model. Gleaned from Schein's writings entitled *Process Consultation: Its Role in Organization Development*, the process model heightens the involvement of members of the organization in the consultant work. Clearly, this perspective contributes directly to building the capacity of the district for addressing future issues.

Consultant Roles



CONSULTANT ROLES*

Expert

Consultant is looked to as the "expert" in the performance of a given task/project. The client expects to hold the consultant responsible for results.

1. Decisions on how to proceed are made by the consultant—on basis of expert judgment.

2. Information needed for problem analysis is gathered by the consultant. Consultant also decides what methods of collection & analysis to use.

3. Technical control rests with the consultant. Disagreement is not likely—consultant has "expert" reasonings.

4. Collaboration is not required.

5. Two-way communication is limited.

6. Consultant plans and carries out implementation or leaves detailed instructions for the client.

7. Client's role is to judge and evaluate at end.

8. Consultant's goal is to solve the immediate problem.

Pair of Hands

Client sees the consultant as an extra "pair of hands". Client says in effect, "I have neither the time nor the inclination to deal with this problem. I have examined the deficiencies and have prepared an outline of what needs to be done. I want you to get it done as soon as possible." The client retains full control. The consultant is expected to apply specialized knowledge to implement action plans toward the achievement of goals defined by the client.

1. Consultant takes a passive role—largely responding to client's requests. Does not question client's action plans.

2. Decisions on how to proceed are made by the client—consultant may prepare recommendations.

3. Client selects methods for data collection and analysis.

4. Control rests with the client—consultant makes suggestions but outright disagreement is avoided because would be seen as challenge to client's authority.

5. Collaboration is not necessary.

6. Two-way communication is limited—client initiates and consultant responds.

7. Client's role is to plan and then to judge and evaluate from a close distance.

8. Consultant's goal is to make the system more effective by the application of specialized knowledge according to the client's direction.

Collaborative

Consultant enters relationship with notion that management issues can be dealt with effectively only by joining own specialized knowledge with the client's knowledge of the organization. Consultant does not solve problems for the client; but rather applies specialized knowledge to help client solve problems. Key assumption is the client must be actively involved.

1. Consultant and client work to become interdependent—share responsibility for work and results.

2. Decision making is bilateral—mutual exchange and respect for responsibilities and knowledge of both parties.

3. Data collection and analysis are joint efforts—including the selection of the kind of data and the method(s) used.

4. Control issues become a matter for discussion and negotiation. Disagreements are expected.

5. Collaboration is considered essential.

6. Communication is two-way. Either can take the initiative depending on the issue.

7. Implementation and responsibilities are determined by discussion and agreement.

8. Consultant's goal is to solve problems so they stay solved.

* Flawless Consulting: A Guide to Getting Your Expertise Used by Peter Block; Learning Concepts, 1981.

ASSUMPTIONS UNDERLYING PROCESS CONSULTATION*

Process consultation assumes that:

1. Managers often do not know what is wrong and need special help in diagnosing what their problems actually are.
2. Managers often do not know what kinds of help consultants can give to them; they need to be helped to know what kind of help to seek.
3. Most managers have a constructive intent to improve things but need help in identifying what to improve and how to improve it.
4. Most organizations can be more effective if they learn to diagnose their own strengths and weaknesses. No organizational form is perfect; hence every form of organization will have some weaknesses for which compensatory mechanisms need to be found.
5. A consultant could probably not, without exhaustive and time-consuming study, learn enough about the culture of the organization to suggest reliable new courses of action. Therefore, he must work jointly with members of the organization who *do* know the culture intimately from having lived within it.
6. The client must learn to see the problem for himself, to share in the diagnosis, and to be actively involved in generating a remedy. One of the process consultant's roles is to provide new and challenging alternatives for the client to consider. Decision-making about these alternatives must, however, remain in the hands of the client.
7. It is of prime importance that the process consultant be expert in how to *diagnose* and how to *establish effective helping relationships* with clients. Effective PC involves the passing on of both these skills.

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*From Edgar H. Schein, *Process Consultation: Its Role in Organization Development*, Reading, Massachusetts: Addison-Wesley Publishing Co., 1969.

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E. Critical Friend Approach to Professional Growth

Primary Question Addressed by Strategy:

• As my district pursues Communications Age learning environments, am I structuring and maximizing the opportunities for professional growth among stakeholders?

Sources, Context, and Support Materials for Strategy:

• Critical Friend Article

The shift from Industrial Age schools to Communications Age schools brings with it dramatic changes in the roles of stakeholders--students, teachers, administrators, school boards, and community members. As educators make transitions from primarily autonomous classroom functioning to more interactive, collaborative functioning, the importance and value of trusting, supportive colleagues is more critical than ever. While not necessarily a new concept, the term "critical friend" is associated with current literature that speaks to this collegial relationship.

The following article from the Assessment in the Learning Organization: Shifting the Paradigm, offers a succinct description of the role and process for maximizing critical friend relationships in school environments. As technology leaders build support for technology as well as build staff capacity for technology applications, they are encouraged to consider the value of critical friend interactions. Ideally, the critical friend structure provides a meaningful strategy for encouraging and supporting professional growth in technology within a context of friendship and trust.

• Tuning Protocol Article

A specific strategy with relevance for enhancing teaching and learning via a critical friend approach is embodied in the "tuning protocol". Described by Kathleen Cushman in the attached article from a publication of *The Coalition of Essential Schools*, the tuning protocol empowers educational stakeholders to engage in the constructive review of teaching and learning processes. Entitled *Making the Good School Better: The Essential Question of Rigor*, the author describes the specific steps associated with implementation of the tuning protocol. Structured to offer constructive feedback within a context of an encouraging environment, the tuning protocol is particularly relevant for educators facing the challenge of new teaching and learning practices associated with educational technologies.

Many educators feel uncomfortable or uncertain about peer collaboration and feedback. Often, the discomfort or uncertainty is heightened within the context of integrating new technological tools. The protocol offers a valuable strategy for addressing this issue constructively and productively to encourage healthy and positive professional growth.

13 Through the Lens of a Critical Friend

ARTHUR L. COSTA AND BENA KALLICK

> Every function in . . . cultural development appears twice: first, on the social level, and later, on the individual level; first between people (interpsychological), and then inside (intrapsychological). This applies equally to voluntary attention, to logical memory, and to the formation of concepts. *All the higher functions originate as actual relationships between individuals.*
>
> —LEV VYGOTSKY

She was waiting for the ophthalmologist to bring her to his office. The routine was a familiar one. Sit in the chair. Place your eyes in the machine that imitates glasses, and tell whether the letters on the wall could be seen better or worse as the focusing lens changed.

We believe that such an eye exam can be an analogy for assessment. It is only when you change the lens through which you view student learning that you find a new focus. If you never change the lens, you limit your vision.

Sometimes your frustration mounts and you ask, "Why do I have to say which lens is better or worse? Can't you just tell me the right prescription?" Furthermore, you need another person to continually change your focus, to guide you to look through multiple lenses in order to find that "just right" fit. And it is not entirely a matter of science. It requires a subjective perspective: "Which looks better or worse to *you*?"

As we work to restructure schools, we become increasingly aware of asking the right questions and collecting appropriate evidence. We are in the business of constantly reframing our work. This suggests that no single perspective on student learning will be suffi-

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learner to see through a different perspective. A typical query might be, "What does the evidence from your students' work indicate to you about their capacity to do problem solving?" or "When you do this project, how will you help others follow your presentation?"

6. Both participants reflect and write. The learner writes notes to himself, an opportunity to think about what has been raised by the conference. For example, will changes make this work better or worse? What have I learned from this refocusing process? The Critical Friend writes to the learner with suggestions or advice that seems appropriate to the desired outcome. This part of the process is distinguished from typical feedback situations in that the learner does not have to respond or make any decisions on the basis of the feedback. It allows the learner to reflect on and process the feedback without defending his work to the critic.

Time for this conference is flexible, though we have found it useful to limit the meeting to about 20 minutes. Once Critical Friends are accustomed to the structure, the time may be shortened.

CRITICAL FRIENDS IN PRACTICE

In the classroom, students use the Critical Friends strategy for conferencing about their writing, project work, and oral presentations. The process provides a formalized way for students to interact about the substantive quality of their work. They are readers of one another's text. They are peer editors and critics. These conferences make the role of assessor a part of the role of learner.

Many teachers guide student Critical Friends to use scoring rubrics—descriptive systems that help them know the rationale behind a rating. Because Critical Friends are advocates for your doing your best possible work, they use only the highest part of any scoring rubric. For example, if 5 is the highest score, the Critical Friend gives feedback to the learner in relationship to indicators described under the score 5. As an advocate for successful, high-quality work, the Critical Friend tries to provide feedback that will stretch the work to its best potential. This feedback session is a little different from others because it frames the conference around performance standards set by the teacher (though the standards are often developed with the collaboration of students).

In staff development, teachers use this Critical Friends strategy to plan and reflect on their process. Instead of the usual show-and-tell kind of sharing, this strategy allows them to understand one another's work at a deeper level. The Critical Friends group can consist of as many as six people. They may meet and share practices every other week. Some teachers do this during their planning period, though there may only be time for one person to share a practice.

Administrators often find themselves too busy to reflect on their practice. In addition, they are isolated from one another. Some administrators have designed Critical Friendships as a part of their working relationships. They call upon their colleagues to provide critiques. One superintendent has called upon board of education members to be Critical Friends from time to time.

The spirit of this new role in assessment practice is to provide a context in which people can receive a response to their work that is at once critical and supportive. For example, a superintendent recently was asked to make a presentation to her board. She was warned that certain board members were difficult; they were often referred to as "bottom line." When she entered the board meeting, she said that she hoped the board would not sit as a panel of judges but as a group of Critical Friends who would help her ask the best possible evaluation questions for the proposed project. She, too, wanted to be able to identify the "bottom line" and then know how to collect data that would evaluate the project. The board, taken off guard, responded favorably. They shifted from asking her questions to helping her ask the right questions. During reflection time, each member offered concerns. As a result, in the privacy of the superintendent's own reflection, she was able to reassess her design work in light of the issues that were raised.

Organizations can also benefit from Critical Friends. In 1993, the giant but faltering blue-chip corporation IBM wooed Louis Gerstner from RJR Nabisco to turn IBM around and make it viable again. Upon assuming his new duties as CEO, Gerstner called in

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HORACE

Making the Good School Better: The Essential Question of Rigor

When we put student work in the spotlight and ask hard questions about its quality, our standards and expectations for all students come into sharp relief. Essential schools that have been successful in many other ways are now reaching for new strategies to raise the bar higher.

BY KATHLEEN CUSHMAN

YOU ARE WORKING IN A PEER coaching situation that has paired you with a good friend who has taught three classrooms down the hall for ten years. He has found it difficult to let you into his classroom, but he finally asked you to come in and observe his Social Studies II Final Exhibitions. He has not asked you to be a judge of the exhibitions (he and a panel of parents are doing that), but rather to look for the public presentation skills of his students. How poised are they? How well do they relate to an audience? You come in, primed to look for those qualities. But what strikes you is the poor content in the performances. What he asked you to look at seems fine; the students are very poised and their public speaking skills are better than average. The parents love the presentations. But the students have a marginal grip on their subjects. They get facts wrong (Rosa Parks didn't start the Montgomery bus boycott in 1968; the War on Poverty did not have a program that targeted the homeless) and they don't link the facts they have to any more general ideas. Your concerns go far deeper than presentation skills. What do you do?

Applicants for the Annenberg Institute's new National School Reform Faculty will write their own answers to that question posed by the Institute's staff at Brown University. But the situation described here is familiar to many thoughtful teachers in Essential schools. It strikes deep personal and political nerves with teachers and administrators, parents and policymakers. It underlies this country's preoccupation with national standards and "the basics," and it also sparks the movement toward more authentic assessments. The quality of student work is shaping up as the dirty little secret of school reform; on its ultimate evidence this wave of innovation must prove its case, or not.

Essential School ideas rest, of course, on the belief that students can do far better than most schools now require. Theodore Sizer's Nine Common Principles call for high academic expectations for all students; for deeper, more focused inquiry; and for the exhibition and defense of student work before a critical audience. The intellectual passivity that marked so many of the classrooms Sizer visited during his 1980s Study of High Schools catalyzed the Coalition's effort to make active and rigorous student inquiry the heart and soul of school reform.

But as schools struggle to reshape their structures to achieve these goals, their focus often shifts to other matters. First, they must get students more engaged—get them to come to school at all, to care about what they do. They must break down isolating barriers so teachers can collaborate, can know

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The Tuning Protocol: A Process for Reflection on Teacher and Student Work

What is it students are asked to do and what is the quality of the work they produce? The tuning protocol asks a teacher to present actual work before a group of thoughtful "critical friends" in a structured reflective discourse aimed at "tuning" the work to higher standards.

In his essay "Three Pictures of an Exhibition," the Coalition's Joseph McDonald describes the "warm" and "cool" responses participants are asked to proffer. Warm, supportive responses identify what is positive in the work, showing "those investments of belief in the performer that arise from a caring history." More objective "cool" responses address the substance of the work, objectively evaluating what is presented (not who presents it), does the test measure what is really valued?

Though it is often used to critique the design and context for exhibitions, the tuning protocol is designed as a way to present student work, in the form of several contrasting samples of written work or a videotaped presentation. Participants then address questions about the extent and quality of the work, and the standards to which it is held. "It may help to think about *qualities* of work, rather than make an overall judgment of quality," CES's David Allen says. "For example, the Prospect Center's 'descriptive review' process asks participants to describe what is there, as well as point out what's missing or weak—a variation of 'warm' and 'cool.'" [See "The Descriptive Review of a Child," by R. D. Kanevsky, in *Authentic Assessment in Practice* (New York: Columbia University, NCREST, 1993.]

In the outline below, the time allotments indicated are the suggested minimum for each task.

I. Introduction (10 minutes)

- Facilitator briefly introduces protocol goals, norms and agenda.
- Participants briefly introduce themselves.

II. Teacher Presentation (20 minutes)

- Context for student work (describing the exhibition's vision, coaching, scoring rubric, etc.)
- Samples of student work (such as photocopied pieces of written work and video clips).

III. Clarifying Questions (5 minutes maximum)

- Facilitator will judge if questions more properly belong in warm or cool feedback than as clarifiers.

IV. Pause to reflect on warm and cool feedback (2-3 minutes maximum)

- Participants may choose to write down feedback items they'd like to share (generally no more than one example of each).

V. Warm and Cool Feedback (15 minutes)

- Participants share feedback on work and its context among themselves while teacher-presenter is silent.
- Facilitator may try to give some focus by reminding participants of an area of emphasis supplied by teacher-presenter.

VI. Reflection / Response (15 minutes)

- Teacher-presenter reflects on and responds to those comments/questions he or she chooses to.
- Participants are silent.
- Facilitator may intervene to clarify or give response focus.

VII. Debrief (10 minutes)

- Begin with teacher-presenter. ("How did the protocol experience compare with what you expected?")
- Talk about any frustrations, misunderstandings, etc. (as well as positive reactions) participants may have experienced.
- More general discussion of the tuning protocol may develop.

GUIDELINES AND NORMS

Guidelines for Facilitators

1. Be assertive about keeping time. A protocol that doesn't allow for all the components will do a disservice to the presenter, the work presented, and the participants' understanding of the process. Don't let one participant monopolize!
2. Be protective of teacher-presenters. By making their work more public, teachers are exposing themselves to kinds of critiques they may not be used to. Inappropriate comments or questions should be recast or withdrawn. Try to determine just how "tough" your presenter wants the feedback to be.
3. Be provocative of substantive discourse. Many presenters may be used to blanket praise. Without thoughtful but probing "cool" questions and comments, they won't benefit from the tuning protocol experience. Presenters often say they'd have liked more cool feedback.

Norms for Participants

1. Be respectful of teacher-presenters. By making their work more public, teachers are exposing themselves to kinds of critiques they may not be used to. Inappropriate comments or questions should be recast or withdrawn.
2. Contribute to substantive discourse. Without thoughtful but probing "cool" questions and comments, they won't benefit from the tuning protocol experience.
3. Be appreciative of the facilitator's role, particularly in regard to following the norms and keeping time. A tuning protocol that doesn't allow for all components (presentation, feedback, response, debrief) to be enacted properly will do a disservice both to the teacher-presenters and to the participants.

"The Tuning Protocol: A Process for Reflection," by David Allen, is forthcoming from the Publications office of the Coalition of Essential Schools (tel.: 401-863-3384).

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their students and their families. They must build trust and community, reshape the schedule to accommodate new aims, involve every voice in governance. So many competing demands press on schools in the midst of change that, even in the most "successful," the rigor question often hides its ugly head.

Those "gold coast" schools where standardized test scores and college acceptance rates are already high often see no need to question how meaningful are the conventional measures most accept as success. The result is what English teacher Margaret Metzger terms "playing school"—"a script we all know," writes this longtime Essential School friend, who teaches at Brookline (MA) High School. "Teachers play school for discipline, routine, and efficiency. Students play school to get good grades, stay out of trouble, and avoid exerting themselves."

At the less privileged end of the spectrum, schools facing desperate odds take pride in success of a different nature. To cut dropout rates and disciplinary incidents, to increase attendance and college admissions, to raise aspirations and get students thinking and caring about intellectual work signifies so much real progress that few will puncture the bubble by pointing out low quality in reading, writing, and mathematical reasoning skills.

Yet as the Coalition enters its second decade, it has trained its sights squarely on this charged and problematic issue. Through several key initiatives, school people at every level are orienting all their efforts toward ratcheting up the quality of the work they ask students to do, the range of students whom they ask to do it, and the measures by which they decide what makes it good enough.

Enabling the Discourse

The crucial first step to this end is for teachers to lay out student work openly for review—by other teachers (both within the school and from other schools), by parents, and by outside experts from the community and the university. This act so threatens the traditional autonomy of the teacher that its success must depend on finding respectful ways to carry it out. To this end, researchers Joseph McDonald, David Allen, and others involved in the Coalition's Exhibitions Project have developed what they call a "tuning protocol"—a highly structured, facilitated discussion in which teachers share student work and receive "warm" and "cool" feedback from teachers and other "critical friends." (See sidebar, page 2.) The kind of student work that does not lend itself well to standard tests—exhibitions, Socratic seminars, portfolios, and the like—will especially benefit from such close critical attention, they believe.

Since its introduction in 1992, the tuning protocol has seen wide use in Coalition-sponsored professional development programs as well as in statewide and local school reform networks in Massachusetts, Rhode Island, New York state, and Chicago. California requires it as a quality review mechanism for all schools receiving grants under the state's 1274 restructuring legislation. And the practice is spreading electronically; Oceana High School in Pacifica, California recently conducted a tuning protocol via interactive television, through the Annenberg Institute's new workshop e.g. (for Educators' Guild), with teachers receiving feedback from colleagues and university professors as far afield as New York's Albert Einstein School of Medicine.

Other efforts share one of the tuning protocol's most important functions: to get faculty to agree on what they regard as exemplary work, and why. At Rancho San Joaquin Middle School in Irvine, California the staff meets regularly to apply an "analytical thinking rubric" to pieces of student work. "This represents a pretty dramatic shift," says Roger King, Rancho's professional development coach. "Every teacher now has a stake in shaping the culture and curriculum of the whole school." Whether they teach highly academic subjects, technology, or physical education, many members of Rancho's staff observe that they have begun to share common standards for analytical work.

Similar strategies have worked well for other schools. "Try getting everybody on the faculty to score the same piece of student work," suggests Grant Wiggins, whose Princeton, New Jersey group CLASS consults widely on assessment issues. "If the range of scores they come up with includes every possible score, that's not acceptable; you need to do something about it." A school culture should tolerate only modest differences in such judgments across the board, he argues, taking explicit steps to clarify their standards and expectations. "Faculty should regularly publish student work, for example—at the very least display the best, worst, and middle range of it on the walls."

HORACE

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he says. "How else will people know what your standards are?"

O'Farrell Community School, a San Diego neighborhood middle school, asks all its sixth- through eighth-grade students to perform the same tasks for assessment at the end of every quarter. Teachers schoolwide then trade the work for scoring—not only to judge what thinking and literacy skills need further classroom attention, but also to gain a sense of student progress over the years at O'Farrell.

In New York City, both Central Park East Secondary School (CPESS) and University Heights High School have invited outside educators, university people, and state education officers to participate in regular audits of their performance standards. The day-long meetings, which involve close looks at student portfolios and videotaped presentations, evoke strong feelings in teachers who must see student work regarded through the eyes of people who cannot know the progress it represents. But "we are looking here at our standards, not specifically at the student," writes CPESS co-director Paul Schwartz in an essay in *Education Week* (November 23, 1994). "It is the school's task to judge the individual, but it is also our responsibility to look outside for help in setting standards."

An even more formal initiative comes from New York state's School Quality Review Board, which sends a team into a school for a week-long external review modeled after Great Britain's school inspection approach. Brought from England to launch the system here, David Green is now developing similar plans with the Southern Maine Partnership and in several other states.

In New Jersey, Grant Wiggins asks the schools he works with to "validate" their standards by having representatives of business, industry, and higher education review the "authenticity" of the assessment tasks and the quality of student performances. A newspaper journalist, for instance, might review a writing assignment and talk over with teachers the standards students would have to meet to produce a publishable article; or a scientist might review a chemistry experiment to see if it reflected laboratory standards in industry. Many technical high schools already require something like this, Wiggins points out, through industry review boards or consulting committees; in a more academic situation, it serves the same purpose of setting a concrete "real world" context by which to assess student progress.

Some areas have set up alliances between a number of schools for the purpose of comparing their standards for student work. The Pacesetter Consortium, for instance, includes a number of New York and New Jersey schools whose faculties agree to mutual critical feedback. The Westchester (NY) Collaborative meets regularly for the same purpose. And the New York Assessment Collection, an emerging computer data base created with a grant from IBM to the Coalition, aims to make digitized examples of student work widely available via computer.

Rigor for All Students

When teachers look at exemplary student work and compare their standards, it can inspire more effective classroom strategies for raising the quality of work. Bringing those same examples into the classroom can have a comparable effect on students themselves. A commitment to rigor seems to include two key characteristics: teaching all students to recognize and strive for the elements of high quality work, and not tolerating shoddy work from students at any academic level. In both, the complication comes from their inclusiveness: *All* students will strive for quality, at *all* academic levels. Ted Sizer calls this "universal goals," his third Common Principle. When they wholeheartedly practice it, Essential schools enter upon a virtual revolution in secondary education.

Opening its doors in 1990 in a booming suburb of Atlanta, Salem High School decided to give all students, regardless of prior achievement levels, the same demanding education. Students learn in heterogeneous groups, whatever the subject; the school offers Advanced Placement courses, but any student who wishes may take them. Salem uses a practice they term the "J-curve" to encourage students to stick with a subject until they attain real competence.

"The state may say that 70 percent is a passing grade," says tenth-grade team member Frances Freedman. "But if you get a 70 in Algebra 1A, you'll be struggling in Algebra 1B. And if you can only write a complete sentence 70 percent of the time, you write like a mess! Why would you want to go on to eleventh-grade writing?"

Instead, Salem advocates revision and retesting along strict guidelines until a student reaches sufficient mastery to move on. "It's not about giving a kid another day to get the homework in," Freedman argues. "They learn to identify and understand their problem areas, then work on them until they qualify for a re-test."

Salem's staff gives plenty of time and energy to making that system work. Using Bloom's taxonomy of thinking skills as its guide, the faculty takes much of its meeting time to discuss how to prompt students to move beyond mere recall toward analysis, synthesis, and other higher-order thinking skills. They design assessments to let students know explicitly which of these skills they are displaying. They take time both in and out of class to coach students who need extra help. And despite initial anxiety, after four years Salem's students, parents, and teachers praise the way this approach has evoked higher quality work from all kinds of students.

"Let's be honest," says English

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teacher Jerry Smith. "Sometimes Advanced Placement students' attitudes actually can be a *block* to rigorous work. They're capable of higher-level work, but they're so used to jumping through hoops to please the teacher that they're not comfortable opening new roads. They can turn out a beautiful essay on a teacher-generated topic, but they're using mid-level thinking skills at best."

It's often the students who *haven't* been so teacher-oriented, Smith says, who can turn their own experiences into original work. "Once you find an entry point to teach all students the basic concept of rhythm in poetry, for instance, these kids will often be able to *apply* that knowledge," he notes. "They'll be the ones who write their own piece in the style of Walt Whitman or Emily Dickinson, and then explain to you what its rhythms are and why. They'll be working at a higher thinking level."

Building the study and evaluation of "best work" into instructional time helps students learn to recognize and internalize high standards, many teachers observe. When a class participates in creating the rubric by which work will be evaluated, for instance, its members have a much higher stake in meeting and applying its criteria.

"They need to be able to describe as explicitly as possible what a discussion looks like when it's being done well," says Eric Sundberg, who teaches social studies at New York's North Shore High School. "The first text I use for a Socratic seminar, for example, is the seminar rubric itself, with its indicators for conduct, listening, reading, and speaking and reasoning. I ask students, 'What would something like this be used for?' You can only get so far into any of these indicators —like 'express yourself logically and clearly'—without asking what it *looks like* when someone is being logical and clear, or shows inappropriate conduct, or speaks too long or too loud." Once having arrived at a shared understanding of quality in these areas, the class then revisits it before every subsequent seminar and spends ten or fifteen minutes afterward evaluating how their discussion measured up. "If students do this every two weeks or so in a given class, the emphasis on quality starts to spill over into other discussion-based classes," Sundberg says. "But you have to reinforce it regularly or it will be lost."

At Central Park East Secondary School, students begin the two-year Senior Institute by reviewing the work of previous graduates in the fourteen portfolios required for graduation here—thus gaining practice in not only meeting the school's standards but raising them. "They talk about standards," writes Paul Schwarz. "Did this project really deserve a distinguished grade? How could it be improved?"

An emphasis on rigor takes as

Indicators of Classroom Thoughtfulness

In his 1991 article "Promoting Higher Order Thinking in Social Studies" (*Theory and Research in Social Education* 19:4), University of Wisconsin education professor Fred M. Newmann describes six key characteristics that can be observed in a thoughtful classroom, condensed with his permission here:

1. There was sustained examination of a few topics rather than superficial coverage of many. Mastery of higher order challenge requires in-depth study and sustained concentration on a limited number of topics or questions. Lessons that cover a large number of topics give students only a vague familiarity or awareness and, thereby, reduce the possibilities for building the complex knowledge, skills, and dispositions required to understand a topic.

2. The lesson displayed substantive coherence and continuity. Intelligent progress on higher order challenges demands systematic inquiry building on relevant and accurate substantive knowledge in the field and working toward the logical development and integration of ideas. In contrast, lessons that teach material as unrelated fragments of knowledge, without pulling them together, undermine such inquiry.

3. Students were given an appropriate amount of time to think, that is, to prepare responses to questions. Thinking takes time, but often recitation, discussion, and written assignments pressure students to make responses before they have had enough time to reflect. Promoting thoughtfulness, therefore, requires periods of silence during which students can ponder the validity of alternative responses, develop more elaborate reasoning, and experience patient reflection.

4. The teacher asked challenging questions and/or structured challenging tasks (given the ability level and preparation of the students). Higher order thinking occurs only when students are faced with questions or tasks that demand analysis, interpretation, or manipulation of information—non-routine mental work. Students must be faced with the challenge of how to use prior knowledge to gain new knowledge, rather than the task of merely retrieving prior knowledge.

5. The teacher was a model of thoughtfulness. To help students succeed with higher order challenges, teachers themselves must model thoughtful dispositions as they teach. Key indicators include showing interest in students' ideas and in alternative approaches to problems; showing how he or she thought through a problem (rather than only the final answer); and acknowledging the difficulty of gaining a definitive understanding of problematic topics.

6. Students offered explanations and reasons for their conclusions. The answers or solutions to higher order challenges are rarely self-evident. Their validity often rests on the quality of explanation or reasons given to support them. Therefore, beyond offering answers, students must also be helped to produce explanations and reasons to support their conclusions.

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many forms as there are good teachers. "So much has to do with the expression in a child's eye, showing he's willing to walk farther down the path," says Jerry Smith. "When a teacher sees that and pushes for more, that's rigor." However and wherever it appears, that habit of high expectations can become an explicit schoolwide value.

"A good school makes very clear that quality always matters more than quantity," Grant Wiggins asserts. "That means plenty of opportunity to revise. It means the work that goes into the final portfolio is revisited and judged to higher standards. No matter how able you are or what course you're in, everyone can produce some quality." What makes schools mediocre, Wiggins contends, is not the best work of the best students. "It's the non-good work of the best students, and the work that's tolerated by all the other students."

Honors by Achievement

Easy enough, some object, to say that a school expects high-level work from every student; it is a more difficult task to attain it. How can one maintain a commitment to high standards regardless of prior achievement levels and still challenge the student who could go much further than most?

That's hard to answer without first deciding just how high those standards ought to be. Teachers at Parkway South High School near St. Louis, Missouri agreed, after months of work, on six areas in which they would share responsibility for coaching all students: communications; personal and social development; artistic creation and interpretation; critical thinking and problem solving; the interrelationship of science, society, and technology; and national and international awareness. Starting with communications, they began methodically to develop diagnostic tasks that would reveal where students stood in each area at the beginning of their high school years, and to work into their regular instruction attention to these overarching skills.

If a student shows early deficiencies in writing, for instance, now all Parkway South teachers share an interest in intervening to supply extra coaching in that area. "Instead of summer school being a warehouse where kids could make up lost credits," says Patrick Conley, the Essential school coordinator, "it becomes a serious effort to improve skills the student has to show before graduation." Kids who used to squeak by with D's, he says, now keep at it until they can show competence.

Where a student reveals special aptitude in a particular area, teachers start early encouraging her to plan a demonstration of "mastery"—an individual performance task at a level beyond the ordinary high school curriculum, overseen by faculty mentors and the school's enrichment facilitator, Anne White. "The emphasis is on gifted *behavior*, not just talent," says White. "The mastery guidelines set professional standards to stretch for—which gives kids the idea that they can tackle things they might not otherwise try. It's a matter of bringing together above-average intelligence, creativity, and task commitment." (See sidebar, page 7.)

Like Parkway South, North Shore High School has refused to rest on its reputation for high achievement. "You always have to be asking how to move every student along to the next level of challenge," principal Elaine Bovrer observes. "We look for any opportunity for students to do independent work." North Shore offers both an independent science research elective and a mathematics research seminar, for instance, in which students from every grade level pursue serious independent projects.

"The honors kids used to write these meaningless book reports on vast topics like probability," says math teacher Rob Gerver, who leads the math research seminar. "Now we ask them to read a three- to six-page article from a math journal, then extend it and build it up on their own. They're *doing* math, not being spoon-fed it." Enrollment has risen steadily, with some students coming back year after year to investigate new topics or continue research from a previous year. "Their papers are a hundred times better," Gerver says.

Not content with conventional standardized tests that show North Shore students among New York state's top achievers, Elaine Bovrer also tracks how they perform against other, more finely tuned measures. "We use the Educational Record Bureau testing service to compare our students' writing performance to that of other high-performing suburban and independent schools," she says. "Since the tests are externally evaluated, they give us a way to compare and validate our own grading standards."

An Honest Report Card?

Many thoughtful educators, in fact, worry about the reliability and validity of their grades, which most systems quantify in ways that seem so ambiguous as to be meaningless. What do grades and scores actually signify about the quality of student work? In a heterogeneously grouped classroom, for example, does every A signify the same level of work? Do high test scores mean students are thinking more critically and generating more thoughtful ideas, or just that they're dutiful or clever regurgitators?

We'll never know, insists Grant Wiggins, until we start reporting grades as if they were baseball statistics—by scoring different facets of performance separately. "Instead, many teachers vary how they calculate their grades from one student to another," he says. "One A might reflect a student's actual problem-solving ability and another might mean the student tried hard and made good progress."

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The trouble rests in the single letter grade, Wiggins asserts; it leads teachers to average things that shouldn't be averaged, and it confuses their expectations for particular students with their standing relative to uniform standards in the field. "We need more, not fewer grades," he argues in his article "Toward Better Report Cards" (*Educational Leadership*, October 1994), "and more different kinds of grades and comments if the parent is to be informed."

The sports fan knows how to interpret the compact statistics on a baseball card, Wiggins says, to tell how well a player is doing in various independent (and unweighted) areas like runs, hits, and strikeouts. Just so, the parent and student need a concise profile of the student's performance in many subcategories —in different genres of writing, for instance. And they need to see achievements and progress reported in different categories.

"Until you disaggregate all aspects of performance you can't demand rigor," he says. "The current grading system forces teachers into fudging and cheating people of the information they need. You've got to be able to let a student know that even though his work is vastly improved, it's still not rigorous."

Letter grades should be used, Wiggins suggests, to symbolize "the normed judgments a teacher makes about the degree to which a student has met expectations." Separate performance scores, by contrast—similar to the scores a gymnast or diver receives in competition—should symbolize "the student's level of achievement on a continuum ranging from novice to expert." Finally, teachers should provide parents with the rubrics and developmental descriptors used in assessing student performance, with a booklet of sample work and anchor papers, and with a narrative describing the student's successes and struggles.

Hard-pressed for time, teachers may prefer Salem High School's practice for grading students in heterogeneous classes. All students work on the same math problems and take the same tests in Algebra I, for instance. But if a student ends up with a 68 average, the report card shows not a D in Algebra but a B in "math." Georgia's designated non–college prep math category

Work in Progress: A School's 'Mastery Guidelines'

In suburban St. Louis, Missouri, Parkway South High School's Enrichment Coordinator, Anne White, offers these "plus, minus, and interesting" observations from the early stages of the school's Schoolwide Enrichment Model (SEM), in which students may outline their own high-level performance to qualify for a "mastery" designation on their transcripts.

PLUS

- Students want to be in charge of their own learning.
- Students who initiate projects usually do so because they "just want to," not because finishing mastery offers rewards.
- Students are willing to take risks.
- Students want to present to an audience.
- Having the program puts the facilitator in touch with students who may need curriculum differentiation.
- Individual projects shift the responsibility for learning to the students, where it belongs.
- Students sense the need for quality products.

MINUS

- The process for mastery is at first confusing to students.
- Students embrace the idea with enthusiasm but burn out before completing the specifics.
- Students become frustrated when there is not enough time.
- The facilitator needs contact with the students on a regular basis.
- Students lack skills related to organization, awareness of resources, and quality products.
- Students are not always successful in finding staff mentors.
- Supervising 100 or more students requires administrative and clerical work (due partly to state guidelines for gifted-talented programs).

INTERESTING

- Schoolwide Enrichment Model is attracting all types of students, though some identified students are not interested.
- An exhibition date may provide a target for completion.
- In some ways, the way the school functions on a daily basis is incompatible with SEM (as when the theater is too heavily booked for additional student use).
- Students appear to be most attracted to mastery projects in Artistic Interpretation and Creation.
- Some students prefer creative expression as a diversion from demanding academic classes.
- Some staff members are willing to compact curriculum for SEM students.
- Mastery is most appropriate for juniors and seniors, though freshmen can set targets.
- Freshmen and sophomores (and some seniors) focus more on enrichment projects that may not be related to mastery.
- Each performance area basically consists of research and presentation.
- Projects should be structured so students can synthesize learning in and out of class.
- Mastery makes the most sense when it is explained one on one.

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"We're teaching them the same things in the same class, so it's not tracking," principal Bob Cresswell asserts of the 16-point adjustment. "They could move up into the next league at any point."

Making Quality Endure

The acid test of what any student has learned in school is not grades in any case, contends Art Powell, the co-author of *The Shopping Mall High School*, who is writing a book about long-term objectives for student learning. "We should concern ourselves with what happens five or ten years down the road—what people remember when they forget what they learned in school." Powell believes that school can ignite a student's interest in something, then give her enough coaching and practice in it to generate habits of mind that last a lifetime. "You want the student to wind up with some set of serious interests and passions about various matters," he argues.

Teachers play a vital role, he says, in nurturing and modeling this outcome. "Good teachers have interests and passions of their own. They are willing to take stands—to make judgments about quality. They create an image of the educated person that clarifies for students what they might get from going beyond conventional dutiful work."

Providing a framework in which teachers might do that has motivated the research of education professor Fred M. Newmann and his colleagues at the University of Wisconsin for the past many years. In a series of articles published in *Theory and Research in Social Education*, they identified some observable elements of a thoughtful classroom. (See sidebar, page 5.) Taking these ideas further in a forthcoming work, they suggest a framework in which teachers can make assessment tasks, instruction, and student performance both more rigorous and more "authentic"—valuable to both student and community beyond the school years. These "authenticity standards," Newmann hopes, will help local teachers and schools define high intellectual quality themselves, without having a host of fragmented standards imposed on them from "experts" at the state and national level.

• • •

With such responsibilities on their shoulders, little wonder that many teachers want time and support, not hard-nosed criticism, as they lead students down more thoughtful paths who once would have slipped through the system unnoticed. But the growing emphasis of Essential School people on looking at student work can be conducted, all these examples show, in a spirit of celebration and growth.

Addressing the question of rigor, in the end, demands both pride and humility from teachers. They must care so much about the integrity of good work that they will not stop until they elicit the very best they believe their students can do. And then they must invite others to look critically at it, too—with the cool eyes of the outsider as well as the warmth of the friend. To develop supports that foster such honest discourse—among students, teachers, and the community—is the lasting task of Essential School reform. ❑

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F. Technology as a Core Value

Primary Question Addressed by Strategy:

- **Am I positioning technology as a core value for my district?**

Sources, Context, and Support Materials for Strategy:

- **Technology as a Core Value Article**

As educational technology becomes more imposing as a vital issue demanding attention, school leaders face the challenge of understanding and positioning technology within a valid and meaningful context in the educational community. In the attached article by Ken Kwajewski, he contends that "The plain truth is that technology still confuses the educational establishment." Entitled *Technology as a Core Value*, the author challenges our thinking about addressing technology in a manner that ensures a thoughtful and effective integration into the teaching and learning process.

Kwajewski encourages educators to embrace technology as a core value and he describes the attributes characteristic of that notation. Equally important, he believes that pursuing technology as a core value contributes to useful definitions of core outcomes for technology. Those outcomes can offer meaning and structure for curriculum organization and development in the educational technology arena. Clearly, Kwajewski's insights offer a productive strategy for considering and addressing technology in a powerful manner that can dramatically impact the teaching and learning process.

Technology as a Core Value

What makes some schools succeed at integrating technology? Can your school successfully implement technology? This article provides a recipe for successful integration of technology into your school system.

By Ken Kwajewski

Are school systems across the country genuinely on the right path concerning the integration of technology into the curriculum? As I attend regional workshops and conferences, I consistently hear the same issues raised. How are you integrating technology? What software programs are you using in mathematics? Are you teaching keyboarding at the elementary level? Do you teach programming languages at your high schools? Do you have computer labs, or are your computers in the classroom? Are you spending funds on networking?

Educators are excited about technology and the possibilities it offers for enhanced classroom instruction. But, these same teachers and administrators still have trouble getting the support they need to integrate technology into their schools.

Why, if most educators believe that technology can improve the educational process, is it so difficult to implement and integrate? Why do so many educators have difficulty deciding how to use technology in the classroom? How can American schools spend so much money on technology yet be so unclear about how to use it? Why are there still so many unanswered questions concerning the use of technology in the classroom?

The plain truth is that technology still confuses the educational establishment. It is not an art or a science. It is not a curriculum or a subject. It is not a vocation or a college requirement. It is not an activity, a goal, or an objective. It is not a course or a program. If it were any of these items, it might have a fighting chance in the difficult arena of change. But it isn't; therefore, its success is in jeopardy.

What is technology then? Technology is a tool that has many things in common with the previously listed educational components. But because it is none of these things, it needs its own place in the educational system.

Many school systems could radically improve their chances of integrating technology successfully if they considered technology a *core value*. As a warrior on the front line of change, I offer the following thoughts on how schools can truly use technology to improve their educational processes.

What Is a Core Value?

Jon Saphier and John D'Auria (1993) define a core value as a "central belief deeply understood and shared by every member of an organization. Core values guide the actions of everyone in the organization; they focus its energy and are the anchor point for all its plans" (p. 3). According Saphier and D'Auria, a core value should permeate all of the organization's undertakings and plans, drive decision making, and be the very last thing the organization would give up. In addition, a violation of the core value should elicit a strong reaction.

Many, if not all, school systems in the United States value technology, but very few see technology as a core value. School systems must see technology as a core value if it is to successfully improve the educational process. Change is very difficult in most school systems, and the only way for technology to make a positive impact on education is to marshal the efforts of everyone.

All schools have spokespersons and constituents that value certain aspects and programs within the school. There are cheerleaders for the arts, the music program, the theater club, community service, the college-preparatory programs, and, of course, athletics. Pick any successful program in the school system of your choice and I would contend that it is very close to a core value for that system. A program that is successful is valued. The following characteristics would probably be evident: a clear vision, administrative backing, a dedicated staff, an adequate budget, an organized curriculum, and a sound evaluation system. A program that is valued is usually successful!

Many staff members take pride in their athletic programs. Why are athletics at most schools successful? It might be because schools have athletic directors, coaches, assistant coaches, trainers, adequate budgets, decent supplies, good equipment, a town feeder program that maintains quality players, great playing fields, and a consistent platform of expectations with a clear evaluation system. With all of these ingredients, the program has to succeed.

But how is technology coordinated in a school system? One participant is usually a harried and overworked media specialist or a technology enthusiast who attempts to do all things for all staff members. He or she is usually the person in constant motion whose message is sometimes lost because of the packaging. Other characteristics of typical technology coordination include a multitude of staff members supplying a multitude of different visions, lukewarm administrative support, a blended department

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of professionals and assistants, a budget that varies with the political wind, isolated technology fires that are soon extinguished, and no truly effective evaluation system that can measure the success of technology integration. This is not a recipe for success, and it appears that this scenario is common to many school systems across the nation.

Why Do You Need a Core Value?

An additional aspect of a core value is that it helps define core outcomes. Core outcomes are "big picture outcomes that are not learned in a single lesson, unit, or perhaps even in a whole course. They are learnings or changes that accrue to our students as a result of having been with us for three or four or six years" (Saphier & D'Auria, 1993, p. 7).

One example of a core outcome for technology might be the following: *Students should graduate from high school knowing how to use technology to improve personal performance.* It sounds simple and easy enough to do, but it must be combined with a commitment to success from the staff in the entire school system.

Using this core outcome, a school system could then generate several grade-level benchmarks to ensure the success of the outcome. These could include the following:

- Students leaving Grade 5 should be proficient in keyboarding and word processing.
- Students leaving Grade 8 should be proficient with an integrated software package.
- Students leaving Grade 12 should be able to locate appropriate sources of information globally.
- Students leaving Grade 12 should demonstrate their mastery of hardware and software applications.

All staff members in a school system must work together to ensure success, not just the ones excited about the potential of technology. All elementary teachers would need to work together to certify that students leaving Grade 5 were proficient keyboarders and word processors. All middle school teachers would need to extend those same skills to an integrated software program that would enhance keyboarding and word processing skills. Finally, high school teachers must actively support technology by offering sound technology courses and by helping students use media centers and online databases around the world. High school teachers would need to reinforce all of the skills learned at the lower levels.

To elaborate more on this example, let's review the keyboarding portion of this core outcome. To make sure that all students are proficient keyboarders, resources must be made available. These include computers, typewriters, or paper keyboards. Staff members must be trained on an appropriate software package (inservice courses would need to be developed and offered). Time

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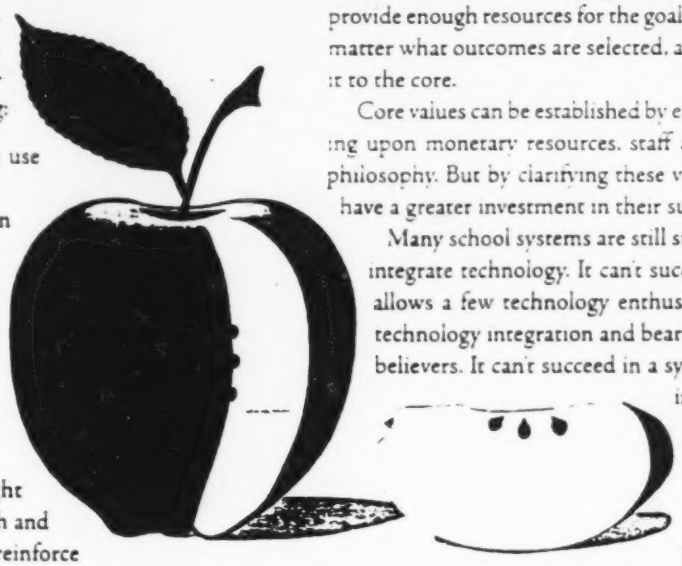
must be allotted during the school year to practice keyboarding. An evaluation system must be developed to encourage success. Results would need to be forwarded to middle and high school teachers. Teachers at the upper grades would ensure continued reinforcement of keyboarding skills. Everyone would know and support the core outcome.

This is not the only possible core outcome school systems might implement to ensure successful technology integration. Another example is the following: *All students will graduate from high school knowing how to locate and evaluate educational resources.* This core outcome would imply that the school system values independent learning and independent research. Students might be taught how to locate information in media centers and local libraries or to navigate the World Wide Web. Courses or units might be established in media evaluation, use of Internet search resources, or online ethics. Benchmarks could include the following:



- Students leaving Grade 5 can use all media resources.
- Students leaving Grade 8 can use the Internet to locate and retrieve information.
- Students leaving Grade 12 will complete an online research paper by gathering information from various Internet resources.

Another school system might take a more conservative approach and use computer software only to reinforce basic skills. Every system is unique, and each should develop its own core outcomes. You can demand keyboarding skills, or you can demand that every student maintain a classroom home page. You can promote basic skills through the use of excellent software, or you can allow for active exploration of information on the Internet. You can promote multimedia projects or encourage use of programming languages. The problem with technology integration is that few systems have accurately determined their core values or core outcomes for technology. Once those have been established, it is easier to develop benchmarks and evaluate those benchmarks at appropriate grade levels.

Making Technology a Core Value

Start small—clarify your core outcomes. Set benchmarks for measurement at various grade levels. Provide the necessary resources that would be given to any successful curricular program. Make the entire educational community responsible for meeting these goals. Developing a few successful core values will help define the role for technology in our school programs and ensure commitment from all constituents.

I contend that if school systems would clearly define and implement a few technology core values, they would have an exemplary technology program. Educators could argue about which grade level each benchmark should be placed at or which type of standard should be reached. Educational leaders could request more emphasis on word processing or process writing, active learning, research skills, Internet access, application software, computer programming, programmed learning, or multimedia applications. School systems could decide to implement active or passive learning environments for technology. But, no matter what technology goals a school system sets, it must provide enough resources for the goals to be met. It really doesn't matter what outcomes are selected, as long as the system values it to the core.

Core values can be established by each school district depending upon monetary resources, staff availability, or educational philosophy. But by clarifying these values, all stakeholders will have a greater investment in their success.

Many school systems are still struggling with how best to integrate technology. It can't succeed in a system that only allows a few technology enthusiasts to carry the cross of technology integration and bear the weight of outside disbelievers. It can't succeed in a system in which technology integration is important to one grade-level teacher but not others. It can't succeed in a system that adds hardware resources but neglects staff training. It can't succeed in a system that spends thousands of dollars on software but can't define any educational expectations for it. It can't succeed in a system that doesn't provide the correct administrative framework, an adequate budget, and an elevated status of importance. It can't succeed in a system that only makes a partial commitment. It can't succeed unless it is a core value. The old adage applies: If something is worth doing, it is worth doing right. Technology integration *can* succeed in a school system that clearly defines it as a core value. ■

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G. Practical Base for Web-based Teaching and Learning

Primary Question Addressed by Strategy:

• Am I structuring or facilitating new teaching and learning practices that build capacity and provide meaningful learning using telecommunications resources?

Sources, Context, and Support Materials for Strategy:

• Making Web Meaning Article

As educators and students engage in accessing web-based resources, they face a new frontier. At least initially, they may find this relatively new resource generally disorganized and lacking the structure typically associated with instructional materials. To heighten the value and probability of meaningful teaching and learning, Bellingham WA leaders focused their energies on three strategies involving the web: a) virtual museums, b) curriculum pages, and c) a research cycle. In the attached article entitled *Making WEB Meaning* by Jamieson McKenzie, the author describes the processes and experiences of engaging students in structured learning experiences with web sites.

The article offers specific strategies for student-constructed virtual museums, for finding good curriculum resources, and for involving students in new approaches to research. Initiating the strategies suggested by the article provides educators and students with opportunities to experience new roles and new practices associated with Communications Age learning environments.

Jamie McKenzie

Making WEB Meaning

Students can triumph over the information overload of the Internet by contributing to virtual museums on their school's Web sites, using annotated Web curriculum lists, and conducting research in cooperative teams.

The once popular "surfing" metaphor is now pretty much discredited as the Internet reveals itself as the greatest yard sale of information in human history. Poorly organized and dominated by amateurs, hucksters, and marketing gurus, the net offers INFO-GLUT, INFO-GARBAGE, and INFO-TACTICS. Schools that plunge students into this INFO-SEA with nothing but mythical or metaphorical surfboards are courting disillusionment, chaos, and what

In building a Web site or conducting research, books are still important to Fairhaven Middle School students and teachers.

beach folk call "Wipeout!" Good planning and staff development can convert the chaos into treasure.

Before schools invest millions of dollars to provide access to the World Wide Web (WWW), they would be wise to stop and ask "Why?"

Bellingham, Washington, Public Schools spent nearly half of its $6 million technology bond on infrastructure to connect all 1,500 desktops across 18 schools to the Internet and each other—in a wide area network. After a year and a half of robust access to the Web, we have found three strategies to make the learning experience most meaningful to the 10,000 students in our 18 schools (12 elementary, 4 middle, and 2 high schools):

- Virtual museums
- Curriculum pages
- The research cycle

Virtual Museums

Because our schools are all connected to the Internet, it was a simple matter to create Web sites (home pages) at each school. We began by asking "Why bother?" in February of 1995.

A quick scan of several hundred school Web sites revealed little of consequence. We found pictures of principals and pictures of buildings. Here and there we found examples of student work. There were lists of Internet sites, but we found little substance, little content, and little utility.

The several dozen staff members—many of whom were library media specialists—who joined in these "virtual field trips" were quick to call for something better. Entranced by the vivid graphics and superb information provided by adult virtual museums such as the Web Museum (http://sunsite.unc.edu/louvre/) and the Franklin Institute (http://sln.fi.edu/), they seized on virtual museums as a centerpiece for Web site development.

Our virtual museums are student-constructed collections of digitized artifacts that illuminate some major aspect of the curriculum. Ellis Island, for example, is one elementary school's virtual museum devoted to diversity, national origin, and immigration. Students (half of whom are first-generation Americans) share the stories of their families' voyages to America from Laos, Cambodia, Vietnam, Greece, and Russia. Another museum, the Fairhaven Turn of the Century Museum, concentrates on local history. (See the next page for Fairhaven's home page.) The students include scanned photos and documents, as well as short video segments, to welcome visitors. For a full listing of Bellingham's museums, go to http://www.bham.wednet.edu/bpsmuse.htm#Bellingham; for a global listing of school museums, go to http://www.pacificrim.net/~mckenzie.

Students act as curators under the tutelage of

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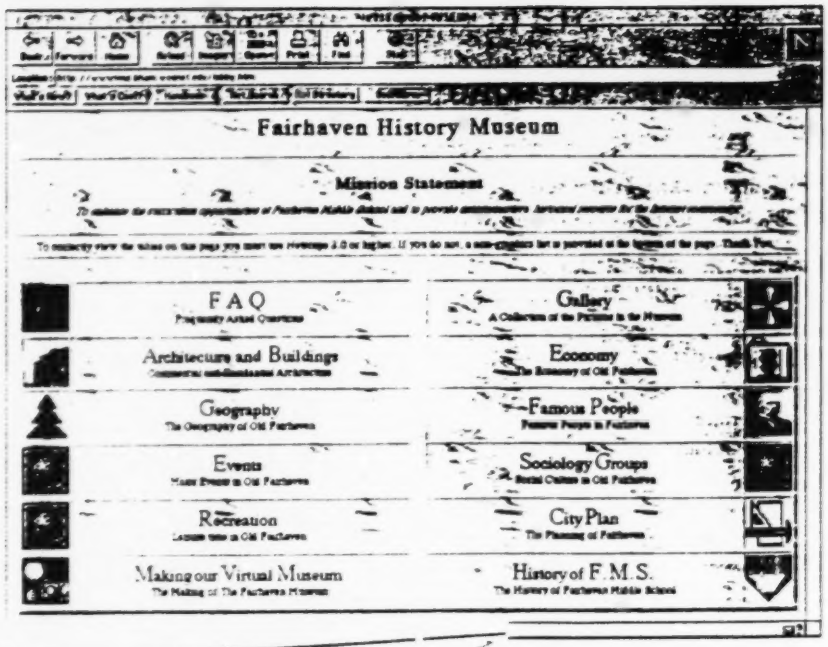


teachers who help them learn the special coding necessary for Web page design (called HTML, or hypertext markup language), as well as the skills of gathering and interpreting artifacts and information. Virtual museums are a great way to engage students in "making meaning" while publishing globally. They challenge students to learn in a fully constructivist manner, building meaning into cyberspace.

Curriculum Pages

The second way we helped our students find good content was through building our own lists of curriculum-related sites—curriculum pages—in our Web searches. We found that many of the lists available did not point us to quality. The typical user had to visit dozens of sites and pass through many levels of menus before finding solid content relevant to the curriculum question at hand.

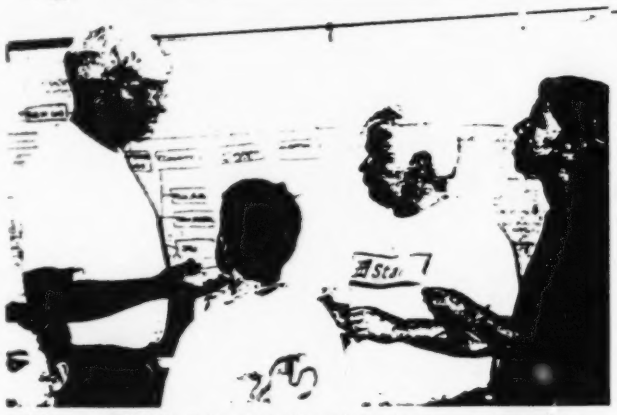
For example, only about 10 percent of *Yahoo's* (http://www.yahoo.com) lists of curriculum-related sites had rich content. Our "curriculum page" team saved dozens and potentially thousands of other teachers the trouble of visiting those "empty" sites by publishing our annotated selections on our Web site.

To examine examples of such lists, visit the Bellingham Public Schools at http://www.bham.wednet.edu.

Because Web lists rarely include annotations and because many of the people who name sites or build lists seem to know little about categorization or labels, it is difficult to identify from simple lists the sites worth visiting. The solution is to add annotations that warn and inform the explorer regarding the site's offerings. These annotations can include comments about whether the site has large graphics (which take a long time to access or download) and can provide a sketch of the content.

To protect explorers from unnecessary and wasteful passages through menu levels, our Web page designers and their student helpers used HTML coding to link the content at useful sites to our page. We would often bypass the introductory pages of these sites and go directly to the heart of the information.

Good curriculum resource lists also offer a healthy alternative for districts concerned about students coming into contact with controversial materials. Staff and students may visit sites on the list (and stay on them) without risk. Such guidance seems preferable to censorship and site-blocking software.



Fairhaven Middle School staff and students meet to plan the Fairhaven turn-of-the-century virtual museum, with a focus on local history.

The Research Cycle

Our third strategy to enrich students' learning experiences involved new approaches to research. We learned quickly that old approaches to student research were inadequate to meet the essential learning goals set by the district and were ill-suited to the information-rich environment we had created with our 1,500-computer network. With all those computers and all those classrooms connected to great information on CD-ROMs and the Internet, we needed to reinvent our concept of research, upgrading the questioning and elevating the reasoning required while encouraging students to work in teams.

Our teachers now participate in a staff development course titled "Launching Student Investigations." This course is based on the *Research Cycle*, first published in *Multimedia Schools* (McKenzie 1995). We teach teams of students to move repeatedly through each step of the research cycle: *questioning, planning, gathering, sorting and sifting, synthesizing, evalu-*

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ating, and *reporting*. After several repetitions, these steps lead to *insight*. (For a detailed description of these phases, see a six-part series of articles published by *Technology Connection* [McKenzie, April 1995 through December 1995].)

Questioning. Most research done for school projects is topical. Students must "go find out about" Dolly Madison or Connecticut. These assignments turn students into simple "word movers."

Virtual museums are a great way to engage students in "making meaning" while [illegible]blishing globally.

New technologies make word moving—cutting and pasting—even more ridiculous. We now emphasize research questions that require either problem solving or decision making. Examples: How might we restore the salmon harvest? Which New England city should our family move to?

Planning. The student teams now carve up the questions into subsidiary questions. They ask: Where might we find the best information? What sources are likely to provide the most insight with the most efficiency? Which resources are reliable? How will we sort, sift, and store our findings? (For example, should we use a database or a word processing file?)

Gathering. If the planning has been thoughtful and productive, the team swiftly and efficiently finds good information sites, gathering only relevant and useful information. Otherwise, [illegible]s might wander for many hours, [illegible]ooping up hundreds of files that will later prove frustrating and valueless. Students must structure findings *as they gather them*. Putting this task off until later is dangerous when coping with INFO-GLUT. In addition, teams need to be aware that they should use the Internet only when that source is likely to provide the best information. In many cases, books and CD-ROMs will prove more efficient and useful.

Sorting and Sifting. The more complex the research question, the more important the sorting and sifting that provides the data to support the next stage—synthesizing. While the teams must select and sort during the previous stage—gathering—now it must systematically scan and organize the data to set aside what is most likely to contribute to *insight*. (McKenzie 1993, 1994)

Synthesizing. In a process akin to working jigsaw puzzles, students arrange and rearrange the information fragments until a pattern begins to emerge. Synthesis is fueled by the tension of a powerful research question.

Evaluating. At this point, the team asks whether more research is needed before proceeding to the *reporting* stage. For complex and demanding research questions, evaluation often requires several repetitions of the cycle. The time to report and share insights is determined by the quality of the information revealed during evaluation.

Reporting. As multimedia presentation software becomes readily available to our schools, our students are increasingly making more persuasive presentations. The research team, charged with making a decision or creating a solution, reports its findings and its recommendations to an audience of decision makers (simulated or real).

Two excellent additional print sources to expand the reader's understanding of information problem solving are Michael Eisenberg's *Big Six* model (Eisenberg and Berkowitz 1990) and Jacqueline and Marty Brooks' 1993 ASCD book, *In Search of Understanding: The Case for Constructivist Classrooms*. An electronic source is the WWW page devoted to constructivist learning (http://www.ilt.columbia.edu/k12/livetext/webcurr.html).

On the Horizon

At Bellingham, our students are developing more information literacy as the information landscape shifts with powerful new technologies. For the same reason, the importance of library media specialists has been growing dramatically, particularly as research becomes central to student-centered, constructivist classrooms. The journey will probably take a full five years of staff development, team planning, and invention—but it is a journey well worth undertaking. The payoff for this investment is the graduation of a generation prepared to make their own meanings in an often confusing, rapidly changing world. ■

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H. Support System for Technology-Related Infrastructure

Primary Question Addressed by Strategy:

• Am I structuring or facilitating leadership and support that ensures appropriate implementation and integration of the district's technology infrastructure?

Sources, Context, and Support Materials for Strategy:

• From the Disk of JDP Article

The attached graphic and article proposes a structure for addressing the critical technical assistance component of establishing and maintaining a successful technology infrastructure. In *From the Disk of JDP*, a *TIE Newsletter* feature, author Jim Parry encourages school leaders to assess the "people" capacity for implementing and supporting technical infrastructure successfully. As technology-related networks and systems become more complex and sophisticated, schools are requiring more on-site expertise to operate the technology reliably and productively. The author suggests a strategy for reviewing and clarifying technical support needs so school leaders can better determine and identify appropriate technical support.

In particular, the author proposes specific attention to three interconnected areas of support: a) technical expertise, b) applications expertise, and c) integration expertise. By reviewing capacity and needs in these areas, it is feasible for school leaders to structure support systems that maximize resources and enhance successful operability.

People Empowerment Components for Technology Infrastructure

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From the Disk of...

by Dr. Jim Parry, Director of TIE

Technology leadership is happening in South Dakota. Clearly, Governor Janklow values the potential of technology for schools and communities. He's wrapped his arms around the issues and he's focused energies on building technical infrastructure through the Wire the Schools (WTS) program. He's tapped and challenged other leaders to get on board.

Many school and community leaders have embraced the WTS opportunity and the momentum is buil ding. WTS is working to meet schools "where they're at." For those schools with a network plan in place, WTS often provides "just in time" support. For those schools without a plan, WTS is the impetus and foundation for building a plan for telecommunications access. Thus, the Governor's efforts set the stage for a host of technology leadership efforts. Any interested, committed educational stakeholder has an invitation to get on board.

I support and applaud the progress with establishing adequate technical infrastructure in schools. As the "wiring" happens, I see leaders asking important questions about what's next. Some leaders are scrambling to identify network configurations to connect to the "wire." Others are pursuing local telecommunication providers to discuss high speed connections, line charges, and services. Still others are assessing the skills and training needs of teachers regarding these new telecommunications tools for the classroom. The most eager leaders are confronting aspects of all of these issues concurrently. On the other end of the continuum are those leaders who are paralyzed by the realities of the imposing telecommunications explosion facing South Dakota schools. But even the most reluctant leaders feel the pressure to get on board.

Whether eager, reluctant, or somewhere in between, school leaders recognize the need for strong leadership that can guide their schools successfully through the haze created by rapidly advancing technology. They want to create a progressive climate that encourages access and integration of telecommunications and other technology applications. They know the technology won't, and shouldn't, go away if schools are genuinely committed to preparing students for the Information Age. They anticipate tough questions from their school board and community members about the plans and progress with technology. As the pressure mounts, they come face to face with their limited knowledge of current and emerging technologies. Many turn to their one hope--the district technology coordinator—the local computer guru who has emerged from the ranks of classroom teachers to lead the technology charge.

Too often and unfairly, all eyes are fixed on the computer coordinator to address and solve the district's technology issues. Perhaps in the early days of computers, it was feasible and reasonable to focus on the expertise of the computer coordinator for technology leadership and implementation. But that paradigm is stretched to the limit. As I interact with local technology leaders, I discover committed educators who are expected to administer the technology program, provide technical expertise, do the trouble shooting, know all the applications, conduct the training, work with colleagues to integrate the technology, and keep abreast of all emerging hardware and software, so the district is positioned to make the right choices for the next acquisitions. In a word, impossible.

As the number of computers in schools has grown, the diversity of software has expanded, the sophistication of the technology has progressed, and telecommunications has evolved, the world of technology has exploded for schools. No one size fits all when considering solutions. It is not simply a matter of getting the paper feeding properly on the pins of the dot matrix printer. The dynamics of technology regardless if the district is small or large require a different model of technology leadership and support. The new model demands the investment of more players. It draws stakeholders—students, teachers, administrators, school boards, and community members—into a process of learning more about the technology and becoming active partners in the decision-making and implementation surrounding technology.

For starters, I encourage school leaders to approach the issue from two directions. The first direction immerses school leaders in an active learning process so they're building personal knowledge bases about current and emerging technologies and related issues. The other direction engages leaders in a process of assessing and clarifying the leadership and support needs of their districts regarding sound technology support and integration. Thus, the first direction is focused on enhancing leaders' capacities as vital contributors to sound decision-making about technology, and the second direction helps them clarify some of their most immediate needs.

The folks pursuing the first direction are not steeped in technical jargon and infrastructure, but they relate to emerging technologies and seek to understand the implications for schools and educational stakeholders. This group includes school leaders who are serious about being informed decision-makers. They recognize their need to pursue opportunities for building their awareness about current and emerging technologies for schools.

(From the disk of...continued on page 14)

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(from the Disk of...continued from page 3)

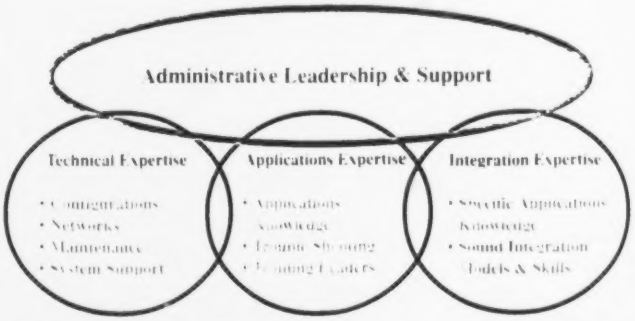
An example of one such opportunity for school leaders is the fast approaching, annual TIE conference. Scheduled for April 13-15 in Rapid City, TIE '97 is designed to offer school leaders a rich and efficient opportunity to gain vital information about technology. Specific workshops and sessions are planned just for administrators, school board members, and community partners. For example, on April 13, Joe Hauge and I will be conducting a workshop entitled *Leadership for Sound Technology Planning*. The session addresses basic information and fundamental issues that school leaders face in confronting technology decision-making responsibly and effectively.

As the Director of TIE, I believe it is so important to engage more school leaders in TIE '97 events that TIE is offering a half-price registration for all school board members and community leaders attending the conference. Certainly, this is the time for school administrators to bring a team of decision-makers to the TIE Conference. For half-price, school board members and community leaders have the best chance of the year to initiate or enhance their knowledge of the latest technology applications for schools. I want school district leaders to take the half-price offer seriously. I wish for them to join with teams from other districts to build their networks and collaboratively address the challenges of technology. I wish for them to view TIE '97 as a benchmark event in their genuine efforts to build their personal capacities as leaders and decision-makers regarding technology.

Now let's capture the second direction for leaders to pursue. It is more systems-oriented and focuses on a valid assessment and understanding of district technology leadership and support needs. I sense the mounting uncertainty and concern about this topic as I visit with school leaders and technology coordinators. To facilitate discussion and help leaders clarify the issues surrounding this topic, I've developed the following graphic. The image focuses on the "people" piece of technology efforts as compared to the technical infrastructure component addressing the wire, equipment, networks, etc. of the system. While the technical piece is critical, it is the "people infrastructure" portion which establishes organization and structure for engaging stakeholders in a manner that maximizes the technical infrastructure.

Clearly, the people empowerment requires commitment and evidence of administrative leadership and support that spans all aspects of the technology program. School leaders, including the "technical and integration support team," need to clarify their roles and organize their energies so technology support and integration is doable and manageable. To accomplish that objective, I'm proposing that schools need to assess and support a "people infrastructure" that addresses three related areas. Thus, the three lower circles of the graphic overlap to reflect connections and interactions between technical expertise, applications expertise, and integration expertise.

People Empowerment Components for Technology Infrastructure



Many school districts still have one person, or perhaps a few persons, who address all three areas of expertise. As districts have gained more computers and the technology has advanced, these people have a tiger by the tail. They're stretched to the breaking point. Thus, school leaders need to assess their support needs across these areas of expertise and identify strategies for building their capacity in each area. As they build capacity, they should clarify roles and identify a structure that offers broad-based support across the areas so technology support and integration needs don't fall through the cracks.

At the technical expertise level, districts need a person or resource (consultant contract or other) for designing, acquiring, implementing, and maintaining a dependable infrastructure of equipment. People in this area actually read and understand instruction manuals of codes and configurations. At the applications level, districts need persons familiar with the diversity of computer applications used to support teaching and learning. They're not steeped in technical terminology but they possess a sound understanding of hardware and software operation so they can assist with maintenance or play an active role in trouble shooting. They address a majority of the day-to-day glitches that overwhelm many teachers. Often, the application specialists conduct training activities and serve as a resource for their colleagues in the classrooms. At the integration expertise level, districts need teachers with a sound knowledge of specific technology applications and skills with integrating the technology to enhance teaching and learning progressively and meaningfully. Under the umbrella of strong administrative

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ership, the three expertise areas interface to offer a breadth and depth of technology support that is essential for valid technology efforts in our schools.

As school leaders contemplate their technology support needs, I encourage them to view their needs through the lens proposed by the "People Empowerment" graphic. Hopefully, by systematically assessing their areas of need, they clarify their view of the most critical areas of support. Equally important, they develop a plan for building their capacity to address all three areas. The data gathered as they look through the "People Empowerment" lens can shape job descriptions for computer leader types so the districts direct their resources and energies as constructively as possible toward building sound and reliable technology support teams. There are many personnel configurations for addressing the three general areas of expertise. The key is developing a framework that closes the gaps in the current technology support system at schools.

Sound leadership? Consider the two directions I've proposed. Make plans for TIE '97 so you're building your personal capacity for technology decision-making. And, clarify your technology leadership and support needs by fitting the "People Empowerment" model to the technology efforts in your district. I believe those two steps can help keep school leaders on board with progressive technology ership. ■

(Students Hybridize...continued from page 12)

find it an interesting thought to ponder in relation to student technology leaders. It offers hope for creative leadership that continually looks for ways to find solutions by bringing together two diverse notions in hybridizing brave new futures.

In the evolution of hybrid development, I'm told, we are very near the point of being able to pick out a plant gene, put it in a single cell, and grow a specific plant. I wonder, in our understanding of the characteristics of student technology leadership, if we will someday reach that point. ■

(Product Review...continued from page 4)

link. The creation, called an *Adventure Link*, might be a simple multimedia report about a landmark or place of interest in the student's home state. The *Adventure Link* file may include text, pictures, drawings, and a video. A special button for access is added to the map in the reference tool. This enables the student to use the reference tool, including the student creation, for presentation purposes. Optional Internet access from within the program connects directly to the VR Didatech Site. The student can then submit his or Adventure Link to be shared, or can download files ed by other students. The program provides excellent preparatory training for learning to publish on the Web. ■

You're Invited!

To be our guest for the...

TIE 97

Keynote Presentation—
Tapping the Power of Networked Multimedia

Featuring
Daniel E. Kinnaman, nationally known educator, author, and consultant

Rushmore Plaza Civic Center Arena
Sunday, April 13 7:00 – 8:30 PM

Imagine teachers, students, and communities with "on-demand" access to a multimedia communications network that brings virtually any information or communication resource (including videotape, CD-ROM, cable TV, video conferencing, videodisc, satellite transmissions, scanned images, still video, and worldwide Internet) directly to their desktops over a local-area network. **Consider** the implications for education policy and school organization. **Experience**, first hand, the power of emerging digital technologies, combined with traditional AV technologies, all in a single integrated system with every resource just a point and click away!

We want to acknowledge and thank the following educational partners for providing the equipment and Internet connection for Mr. Kinnaman's Keynote Address: Compaq Computer Corporation, Safari Technology, Inc. (formerly Dynacom Corporation), and Internet provider MCI.

One lucky member of the Keynote audience will win a Compaq computer!

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I. Measurement of the Instructional Use of Technology

Primary Question Addressed by Strategy:

- **Am I embracing and practicing a new paradigm of teaching and learning that positions technology as a powerful catalyst in the school reform process?**

Sources, Context, and Support Materials for Strategy:

- **Computer Efficiency Article**

In the attached article entitled Computer Efficiency: Measuring the Instructional Use of Technology, author Christopher Moersch offers an instrument for assessing computer efficiency within the context of a school reform process. He defines computer efficiency "as the degree to which computers are being used to support concept-based or process-based instruction, consequential learning, and higher order thinking skills (e.g. interpreting data, reasoning, solving real-world problems)."

Clearly, the instrument and associated process provides school leaders with a potential strategy for reviewing current instructional practices with technology, and making judgments about the congruencies of those practices with a new paradigm of teaching and learning associated with Communications Age schools.

nputer Efficiency

EASURING THE INSTRUCTIONAL USE OF TECHNOLOGY

By Christopher Moersch

Use the instrument described in this article to evaluate your computer efficiency in support of concept-based and process-based instruction, consequential learning, and the development of students' higher order thinking skills.

A local news station documenting the current status of computers in the schools recently provided a provocative comparison between the stereotyped "haves" and "have nots." At one school, parents, teachers, and students were viewed as trapped with aging Apple IIe computers collecting dust in some remote computer lab while their contemporaries on the other side of the tracks were seen enjoying the fruits of a recently passed bond levy that had brought them new Power Macintosh computers with full AV capability connected by an Ethernet network with unlimited access to the global Internet.

The reality of the situation is that kids are no better off in either an aging Apple IIe lab or a new Macintosh/Windows lab if a fundamental shift has not been made in the way technology is being integrated in the classroom. This shift involves recommissioning existing computers (yes, even those old Apple IIe, Macintosh SE/30s, and IBM XTs) as data analysis centers, probeware stations, multimedia publishing outlets, and research kiosks to prompt students to think, reason, make informed decisions, and communicate information based on the available data.

A myriad of research and conceptual papers have documented the modest impact technology has made toward altering the prevailing curriculum design based on subject matter and its emphasis on sequential instructional materials, traditional verbal activities, and expository teaching strategies (O'Neil, 1995; Stoddard & Niederhauser, 1993;). According to the Office of Technology Assessment, the most common uses of technology today are the use of videos for presenting information, the use of computers for basic skills practice at the elementary and middle school levels, and the use of word processing and other generic programs for developing computer-specific skills in middle and high schools" (O'Neil, 1995).

The often-cited reasons for technology's meager performance are common to most educational change efforts: inadequate staff development, lack of teacher preparation time, insufficient equipment, and a basic lack of an overall vision.

An Instrument for Measuring Technology Use

Clearly, educational practitioners need to embrace a new paradigm that positions technology as a powerful catalyst in the school reform process. To aid in this process, I have developed an instrument that measures computer efficiency at the school site level. The term *computer efficiency* is defined as the degree to which computers are being used to support concept-based or process-based instruction, consequential learning, and higher order thinking skills (e.g., interpreting data, reasoning, solving real-world problems). The instrument is based primarily on my previous work (Moersch, 1995) and my identification of specific levels of technology implementation. A framework describing the levels of technology implementation (LoTi) is given in Table 1. The LoTi framework categorizes six levels of computer efficiency, ranging from Nonuse (Level 0) to Refinement (Level 6).

As a school site progresses from one level to the next, a corresponding series of changes to the instructional curriculum is observed. The instructional focus shifts from a teacher-centered to a learner-centered orientation. Table 2 shows three developmental levels and the changes that occur in instructional practices at each level as a school site changes its orientation.

It should be noted that this approach to measuring computer efficiency de-emphasizes the importance of (1) the brand, type, or age of computers at the school site; 2) the ratio of computers to students; and (3) the amount of funding allocated for infrastructure (e.g., modems, cable, networking configurations). Instead, primary emphasis is given to the degree that technology is used to support a constructivist orientation to classroom

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Table 1. The LoTi Framework

Level	Category	Description
0	Nonuse	A perceived lack of access to technology-based tools or a lack of time to pursue electronic technology implementation. Existing technology is predominately text-based (e.g., ditto sheets, chalkboard, overhead projector).
1	Awareness	The use of computers is generally one step removed from the classroom teacher (e.g., it occurs in integrated learning system labs, special computer-based pull-out programs, computer literacy classes, and central word processing labs). Computer-based applications have little or no relevance to the individual teacher's instructional program.
2	Exploration	Technology-based tools serve as a supplement (e.g., tutorials, educational games, simulations) to the existing instructional program. The electronic technology is employed either for extension activities or for enrichment exercises to the instructional program.
3	Infusion	Technology-based tools including databases, spreadsheets, graphing packages, probes, calculators, multimedia applications, desktop publishing, and telecommunications augment selected instructional events (e.g., science kit experiments using spreadsheets or graphs to analyze results, telecommunications activities involving data sharing among schools).
4a	Integration (mechanical)	Technology-based tools are mechanically integrated, providing a rich context for students' understanding of the pertinent concepts, themes, and processes. Heavy reliance is placed on prepackaged materials and sequential charts that aid the teacher in the daily operation of the instructional curriculum. Technology (e.g., multimedia, telecommunications, databases, spreadsheets, word processing) is perceived as a tool to identify and solve authentic problems relating to an overall theme or concept.
4b	Integration (routine)	Teachers can readily create integrated units with little intervention from outside resources. Technology-based tools are easily and routinely integrated, providing a rich context for students' understanding of the pertinent concepts, themes, and processes. Technology (e.g., multimedia, telecommunications, databases, spreadsheets, word processing) is perceived as a tool to identify and solve authentic problems relating to an overall theme/concept.
5	Expansion	Technology access is extended beyond the classroom. Classroom teachers actively elicit technology applications and networking from business enterprises, governmental agencies (e.g., contacting NASA to establish a link to an orbiting space shuttle through the Internet), research institutions, and universities to expand student experiences directed at problem solving, issues resolution, and student activism surrounding a major theme or concept.
6	Refinement	Technology is perceived as a process, product (e.g., invention, patent, new software design), and tool for students to use in solving authentic problems related to an identified real-world problem or issue. In this context, technology provides a seamless medium for information queries, problem solving, and product development. Students have ready access to and a complete understanding of a vast array of technology-based tools to accomplish any particular task.

pedagogy based on the available hardware and software at the school site. By using the Computer Efficiency Rating Chart on page 55, school districts can reexamine their technology purchasing practices, staff development opportunities, and organization of the school day in light of a much broader goal—elevating the level of technology implementation systemwide.

Two Real-World Computer Efficiency Audits

Schools can use the Computer Efficiency Rating Chart to conduct a technology audit using the computer efficiency instrument. For example, the two schools identified in Tables 3 and 4 on page 56—Allendale Elementary School and Evergreen Elementary School—recently completed the audit, allowing them to assess their results in an objective, informed way.

Allendale Elementary School is equipped with a new Macintosh computer lab complete with Internet hookup and a local area network (LAN) connected to the district's wide area network (WAN). Most of the computers in the lab at Allendale are used as workstations where students develop their computer literacy (e.g., keyboarding) skills or as integrated learning system (ILS) terminals where they improve their basic math and communication skills. In the classrooms, the computers are used mostly for activities (e.g., students playing drill-and-practice games at the end of the class period, making simple movies using HyperStudio, and sending e-mail messages over the Internet). These activities supplement the teachers' instructional curricula. Fifteen percent of the computers are not used during the instructional day.

At Evergreen Elementary School, a "learning lab" is equipped with 10 Power Macintosh computers. The remaining computers are distributed in classrooms throughout the school. The learning lab has full Internet capabilities and is used exclusively for student information

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searches, purposeful multimedia production, and data analysis. In the classroom, teachers use their Apple IIe and 286 computers as data analysis and "groupeware" stations where students gather, tabulate, and graph data for various instructional activities. They also use the computers to solve pertinent and relevant problems related to an underlying theme or concept.

From this brief account of computer use at the two elementary schools, the following points emerge:

1. The level of computer efficiency is influenced directly by how teachers are using computers to develop students' higher order thinking skills.
2. Neither the age or type of computers or the level of telecommunications infrastructure has an impact on the efficiency rating.
3. The differences in the socioeconomic status of the two schools was not a factor in the efficiency of their computer use.

These points closely parallel the findings from Becker's 1995 study of exemplary computer-using teachers. Using national survey data collected from teachers of academic subjects in grades 5–12, Becker identified roughly 5% (45 out of 516 teachers) as being exemplary computer-using teachers. Exemplary computer-using teachers were defined as educational practitioners who engaged students in computer-based activities that involved higher order thinking. These activities included interpreting data, reasoning, writing, solving real-world problems, and conducting scientific investigations. Contrary to expectations, the exemplary computer-using teachers Becker identified did not disproportionately teach classes of high-ability students, nor were they overrepresented in more socioeconomic communities.

What's the Solution?

Unfortunately, changing classroom practices so that they unleash the potential of computer technology will never occur if purchase-order acquisitions of new hardware and infrastructure items take precedence over quality staff development opportunities. The billions of educational dollars that have already been spent during the past 20 years on hardware ranging from Commodore 64s to Power Macintoshes attest to this fundamental fact. As with any change effort, our investment needs to be in teachers and not exclusively in hardware. The Computer Efficiency Rating Chart described in this article was designed to help educational practitioners bridge this gap between computer acquisitions and computer use by providing valuable baseline data for a school's current computer efficiency profile. Such data can be instrumental in shaping future staff development interventions that target elevated levels of technology implementation. ■

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Table 2. Levels of Instructional Practices

	Level 1	Level 2	Level 3
Learning Materials	Organized by the content, heavy reliance on textbook and sequential instructional materials	Emphasis on science kits, hands-on activities (e.g., AIMS, FOSS)	Determined by the problem areas under study, extensive and diversified resources
Learning Activities	Traditional verbal activities, problem-solving activities	Emphasis on student's active role, problem-solving activities with little or no context, verification labs using science kits and related hands-on experiences	Emphasis on student activism and issues, investigations and resolutions, authentic hands-on inquiry related to a problem under investigation, focus on experiential learning
Teaching Strategy	Expository approach	Facilitator, resource person	Colearner or facilitator
Evaluation	Traditional evaluation practices, including multiple choice, short answer, and true/false questions	Multiple assessment strategies including performance tasks and open-ended and problem-based questions	Multiple assessment strategies integrated authentically throughout the unit and linked to the problem/theme/topic, portfolios, open-ended questions, self-analysis and peer review
Technology	Computer-based drill-and-practice programs (e.g., traditional integrated learning systems [ILS] computer games), little connection between technology use and overall theme or topic	Technology integrated into isolated hand-on experiences (e.g., the tabulation and graphing of data to analyze a survey or experiment), information searches using telecommunications	Expanded view of technology as a process, product, and tool to find solutions to authentic problems, communicate results, and retrieve information (e.g., use of spreadsheets, graphs, probes, databases, CD-ROM-based simulations, and telecommunications)

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Computer Efficiency Rating Chart

A Descriptor	B Level	C Computer Use %	D Student Use %	E Computers (#)	F Product (B x C x D x E)
Nonuse	0				
Awareness	1				
Exploration	2				
Infusion	3				
Integration	4				
Expansion	5				
Refinement	6				
	Total	100%			G

H Number of Computers _____

I Insert total from box G = _____

Multiply the total in Box H by 4 (Level 4) = _____

J _____ % = Computer Efficiency Rating

Instructions

1. In Column A, review the descriptors associated with the levels of technology implementation in the LoTi framework chart (see Table 1, page 53).
2. In Column B, review the corresponding level of technology implementation associated with each descriptor.
3. In Column C, insert the percentage of computer use at each level (e.g., 50% at Level 2, 25% at Level 3). This category should total 100%. This column shows how computers are being used at the school site. In fact, you should be able to graph the data in this column as a pie chart.
4. In Column D, insert the percentage of students using computers at each level. This category will not total 100%. Theoretically, all students in the school might cycle through a computer lab (Level 1) in the morning but then use the computer at a data analysis station (Level 4) in their science or math classrooms in the afternoon.
5. In Column E, insert the number of computers used at each level. Again, this category will not total 100% because the same computers could conceivably be used for keyboarding during Period 1, drill and practice during Period 3, and analyzing data during Periods 5 and 6.
6. In Column F, enter the result of multiplying the numbers in columns B, C, D, and E.
7. In Box G, enter the sum of all the products (B x C x D x E) found in Column F.
8. In Box H, enter the number of computers used for instructional purposes at the school site or classroom.
9. In Box I, insert the total from Box G as the numerator.
10. In Box I, multiply the total number of computers shown in Box H by 4. Enter this number as the denominator. (The 4 represents Level 4 on the LoTi chart and serves as the minimum standard for effective technology implementation.)
11. In Box J, enter the quotient from Box I and convert it to a percentage. This percentage represents the Computer Efficiency Rating for your school or classroom.

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Table 3. Allendale Elementary School

A Descriptor	B Level	C Computer Use %	D Student Use %	E Computers (#)	F Product B x C x D x E
Nonuse	0	10%	10%	6	0
Awareness	1	50%	50%	20	5
Exploration	2	25%	40%	8	1.6
Infusion	3	15%	20%	4	.36
Integration	4	10%	10%	2	.08
Expansion	5	0%	0%	0	0
Refinement	6	0%	0%	0	0
	Total	100%			G 7.04

H Number of Computers | 40 |

I Insert total from box G = 7.04
Multiply the total in Box H by 4 (Level 4) = 160

J 4.4% = Computer Efficiency Rating

Student Population	Approximately 250 students
Socioeconomic Status	3% of students on federal free-lunch program
Staff Members	20 full-time certificated personnel
Computers	35 Power Macintosh computers and 5 Macintosh LC II
Network	Ethernet
Telecommunications	Direct Connection T1 line
Computer Efficiency Rating	4.4%

Table 4. Evergreen Elementary School

A Descriptor	B Level	C Computer Use%	D Student Use %	E Computers (#)	F Product B x C x D x E
Nonuse	0	0%	0%	0	0
Awareness	1	0%	0%	0	0
Exploration	2	25%	20%	10	1.0
Infusion	3	20%	75%	8	3.6
Integration	4	50%	100%	20	4.0
Expansion	5	5%	10%	2	.05
Refinement	6	0%	0%	0	0
	Total	100%			G 44.65

H Number of Computers | 40 |

I Insert the total from Box G = 44.65
Multiply the total from Box H by 4 (Level 4) = 160

J 27.91% = Computer Efficiency Rating

Student Population	Approximately 250 students
Socioeconomic Status	65% of students on federal free-lunch program
Staff Members	20 full-time certified personnel
Computers	25 Apple IIe computers, 5 Power Macintosh computers, and 10 DOS 286 computers
Network	None
Telecommunications	Slip Access (local provider)
Computer Efficiency Rating	28%

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Technology Leadership Workshop Evaluation Form

Technology Leadership Workshop Evaluation Form

I'm leaving the workshop with . . .

- an enhanced or affirmed "big picture" of current school change issues related to technology

Not at all 1 2 3 4 5 6 7 Yes and More

- current, useful materials addressing technology leadership issues

Not at all 1 2 3 4 5 6 7 Yes and More

- more clarity about my beliefs, vision, and needs for my district's technology efforts

Not at all 1 2 3 4 5 6 7 Yes and More

- new strategies for enhancing my technology leadership efforts

Not at all 1 2 3 4 5 6 7 Yes and More

- expanded network of colleagues regarding technology efforts

Not at all 1 2 3 4 5 6 7 Yes and More

Indicate the degree to which the following components contributed to the workshop effectiveness . . . .

- presentation of "big picture" and related technology issues

None 1 2 3 4 5 6 7 Greatly

- resource materials and activities included in workshop manual

None 1 2 3 4 5 6 7 Greatly

- workshop participant and small group activities re: beliefs, vision, and needs

None 1 2 3 4 5 6 7 Greatly

- suggested strategies and support information included in workshop manual

None 1 2 3 4 5 6 7 Greatly

- network opportunities with other workshop participants

None 1 2 3 4 5 6 7 Greatly

What did you like best about this workshop?

In what ways will this workshop be useful to you?

What improvements would your suggest for offering the workshop in the future?

Any additional comments?